

Wylie, Andrew T.

THE OPPOSITES TEST

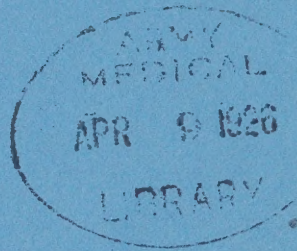
BY

ANDREW TENNANT WYLIE

INDEXED

NK

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE
FACULTY OF PHILOSOPHY, COLUMBIA UNIVERSITY



A. C. Miller

Published by

Teachers College, Columbia University

New York City

1925

THE OPPOSITES TEST

BY

ANDREW TENNANT WYLIE

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE
FACULTY OF PHILOSOPHY, COLUMBIA UNIVERSITY

Published by

Teachers College, Columbia University

New York City

1925

Copyright, 1920, 1921, 1925, by ANDREW TENNANT WYLIE

All Rights Reserved

TO THE MEMORY
OF
E. J. W.

ACKNOWLEDGMENTS

The writer wishes to acknowledge the courtesies and helpfulness of the many persons who in one way or another made possible the carrying out of this experiment.

Thanks are especially due to the following: Mrs. Edna O. Maule, principal of the Garden City School; Dr. Raymond Franzen, of the University of California, formerly psychologist at Garden City and later director of research at Des Moines, Iowa; Examiner Louis Marks, formerly principal of Public School 64, New York City, and Miss Regina C. M. Burke, assistant principal of the same school; Mr. Benjamin Mandel, instructor in the Julia Richman Annex, New York City; Mr. John D. Minnick, executive officer of the High School of Commerce, New York City; the English department of Teachers College, particularly Professor Allan Abbott and Miss Helen E. Diller; Dr. John L. Stenquist, director of the Bureau of Research, Baltimore, formerly acting assistant director of the Bureau of Reference and Research, New York City, and Professor Henry A. Ruger, of Teachers College.

To the insight, patience, and wise guidance of Professor Edward L. Thorndike, the writer is indebted most of all.

A. T. W.

CONTENTS

	PAGE
INTRODUCTION	xiii
CHAPTER	
I. THE TEST	1
METHODS OF SELECTING LISTS AND GIVING TEST	4
RULES FOR SCORING	11
KEY	14
II. THE POPULATION TESTED	31
III. THE RELIABILITY OF THE TEST	38
IV. THE SIGNIFICANCE OF THE TEST AS A MEASURE OF INTELLIGENCE	46
V. THE SIGNIFICANCE OF THE TEST AS A MEASURE OF SPECIAL ABILITY	67
VI. NORMS AND STANDARDS	73
VII. STATISTICAL METHODS	91
BIBLIOGRAPHY	93

TABLES

NO.		PAGE
I.	OPPOSITES POPULATION BY GRADE AND SEX. GARDEN CITY.	31
II.	OPPOSITES POPULATION BY GRADE. PUBLIC SCHOOL 64....	32
III.	OPPOSITES POPULATION BY CLASSES AND GRADES.....	32
IV.	OPPOSITES POPULATION BY TERMS. JULIA RICHMAN HIGH SCHOOL ANNEX.....	33
V.	OPPOSITES POPULATION BY TERMS. HIGH SCHOOL OF COMMERCE.....	34
VI.	OPPOSITES POPULATION BY TERMS. HIGH SCHOOL OF COMMERCE.....	34
VII.	OPPOSITES POPULATION. ENGLISH A AND B. TEACHERS COLLEGE.....	34
VIII.	OPPOSITES POPULATION. THORNDIKE GROUP.....	36
IX.	RELIABILITY OF OPPOSITES. SCHEME OF SAMPLING FOR 195 CASES. PUBLIC SCHOOL 64.....	40
X.	RELIABILITY OF OPPOSITES. AVAILABLE CASES. JULIA RICHMAN ANNEX.....	40
XI.	CORRELATION BETWEEN FEBRUARY OPPOSITES AND JUNE OPPOSITES SERIES.....	<i>facing</i> 40
XII.	CORRELATION BETWEEN WYLIE OPPOSITES A, B AND OPPOSITES C, D.....	41
XIII.	RELIABILITY OF OPPOSITES. CASES FOR HIGH SCHOOL OF COMMERCE.....	41
XIV.	RELIABILITY COEFFICIENTS FOR OPPOSITES FOR ALL GROUPS	42
XV.	RELIABILITY OF COLUMBIA COLLEGE EXAMINATIONS.....	43
XVI.	RELIABILITY COEFFICIENTS FOR ROGERS' SEXTET.....	44
XVII.	COEFFICIENTS QUOTED FROM ABBOTT AND TRABUE, BRIGGS, AND WOOD.....	44
XVIII.	MENTAL AGE POPULATION.....	47
XIX.	QUOTIENT POPULATION. GARDEN CITY.....	48
XX.	CORRELATION BETWEEN WYLIE OPPOSITES AND SIX FACTORS.....	49
XXI.	CRITERION POPULATION BY CLASSES. PUBLIC SCHOOL 64...	50
XXII.	CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION. PUBLIC SCHOOL 64. TEN-YEAR-OLDS.....	51

NO.	PAGE
XXIII. CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION. PUBLIC SCHOOL 64. ELEVEN-YEAR-OLDS.....	52
XXIV. CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION. PUBLIC SCHOOL 64. TWELVE-YEAR-OLDS.....	53
XXV. CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION. PUBLIC SCHOOL 64. THIRTEEN-YEAR-OLDS.....	54
XXVI. CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION. PUBLIC SCHOOL 64. FOURTEEN-YEAR-OLDS.....	55
XXVII. CORRELATION OF OPPOSITES WITH CRITERION FOR EACH AGE-GROUP. PUBLIC SCHOOL 64.....	56
XXVIII. CORRELATION OF VARIOUS INTELLIGENCE TESTS WITH CRITERION. PUBLIC SCHOOL 64.....	56
XXIX. POPULATION FOR HAGGERTY DELTA 2. PUBLIC SCHOOL 64..	57
XXX. CORRELATION BETWEEN WYLIE OPPOSITES AND HAGGERTY DELTA 2 (1ST HALF)..... <i>facing</i>	58
XXXI. CORRELATION BETWEEN WYLIE OPPOSITES AND HAGGERTY DELTA 2 (2ND HALF)..... <i>facing</i>	58
XXXII. CORRELATION BETWEEN WYLIE OPPOSITES AND NATIONAL INTELLIGENCE TESTS..... <i>facing</i>	58
XXXIII. CORRELATION BETWEEN WYLIE OPPOSITES AND NATIONAL INTELLIGENCE TESTS..... <i>facing</i>	58
XXXIV. CORRELATIONS OF OPPOSITES WITH HAGGERTY DELTA 2 AND NATIONAL INTELLIGENCE TEST.....	58
XXXV. SCORES FOR PUBLIC SCHOOL 64.....	58
XXXVI. TERM GRADES FOR EACH SCHOOL SUBJECT AVAILABLE FOR COMPARISON WITH OPPOSITES. HIGH SCHOOL OF COM- MERCE.....	59
XXXVII. CORRELATION BETWEEN WYLIE OPPOSITES AND TERM GRADES. HIGH SCHOOL OF COMMERCE.....	61
XXXVIII. CORRELATION BETWEEN TERM GRADES AND THORNDIKE CRITERION..... <i>facing</i>	62
XXXVIII A. CORRELATION BETWEEN WYLIE AND TERM GRADES. THORNDIKE GROUP.....	64
XXXIX. CORRELATION BETWEEN SCORES IN VARIOUS INTELLIGENCE TESTS AND SUCCESS IN COLLEGE.....	65
XL. CORRELATION BETWEEN WYLIE OPPOSITES AND KELLEY- TRABUE..... <i>facing</i>	68
XLI. CORRELATION BETWEEN WYLIE OPPOSITES AND THORNDIKE VISUAL VOCABULARY.....	68
XLII. CORRELATION BETWEEN WYLIE OPPOSITES AND WOODY- MCCALL.....	69
XLIII. CORRELATION OF TERM GRADES IN ENGLISH A AND B (TEACHERS COLLEGE) WITH SCORES IN OPPOSITES.....	71

Tables

xi

NO.	PAGE
XLIV. FACTORS USED IN ADJUSTING THE POPULATION OF PUBLIC SCHOOL 64 TO CONFORM TO THE PROPORTIONS OF THE SCHOOL ENROLLMENT FOR THE BOROUGH OF MANHATTAN.	74
XLV. METHOD OF ADJUSTING THE OPPOSITES SCORES FOR PUBLIC SCHOOL 64.....	74
XLVI. REDUCED TABULATION FROM DATA OF TABLE LIII	75
XLVII. REDUCED TABLE FROM TABLE LIV. DES MOINES.....	76
XLVIII. SCORES IN WYLIE OPPOSITES. DES MOINES.....	<i>facing</i> 76
XLIX. MEDIAN SCORES BY AGE FOR THE HIGH SCHOOL GROUP..	78
L. PROVISIONAL STANDARDS FOR OPPOSITES A, B, C, D.....	79
LI. SCORES BY GRADES FOR A, B, C, D—1792 CASES. PUBLIC SCHOOL 64.....	80
LII. DISTRIBUTION OF POPULATION (ADJUSTED).....	81
LIII. MEDIAN SCORES BY AGE AND GRADE (ADJUSTED) FOR A, B, C, D. PUBLIC SCHOOL 64.....	83
LIV. AVERAGE SCORE BY GRADES FOR AGES 10, 11, 12, 13 AND 14.	85
LV. COMBINED SCORES OF HIGH SCHOOL OF COMMERCE AND JULIAN RICHMAN ANNEX.....	86
LVI. COMBINED SCORES OF HIGH SCHOOL OF COMMERCE AND JULIA RICHMAN ANNEX.....	87
LVII. SCORES FOR ENGLISH A AND ENGLISH B. TEACHERS COLLEGE.....	88
LVIII. SUMMARY OF SCORES IN A, B, C, AND D (TAKEN SEPARATELY). ENGLISH A AND ENGLISH B.....	89
LIX. SCORES FOR THE THORNDIKE GROUP.....	90

INTRODUCTION

The Opposites have had an ancient and honorable career, as family histories run, in the genealogy of mental tests. As nearly as the writer can determine, both by examining published reports and by personal inquiry of some of the psychologists who have been most closely identified with the early experiments with Opposites, the credit for devising them belongs to Professor E. L. Thorndike. Since the first account in 1902 [1] * there have been many lists published and a variety of methods of administration and scoring developed.

However, in spite of the very great amount of work already done, it has seemed worth while to the writer to carry on a somewhat extended experiment which would result in a new type of Opposites (the Alphabetical Opposites) and which would cover a wide range both in the difficulty of the stimuli and in the age and ability of the persons tested. A share of the incentive for this study is due to a quotation from Whipple:

"We have no tests of moderately difficult and very difficult opposites that have been tested by very extensive experimentation." [2]

Some modification of this statement is necessary, now after the lapse of ten years, especially since the appearance of the Army Alpha tests and the work of King and Gold [3], Greene [4], Van Wagenen [5], and Means [6]. However, there is still a very great need for just what Whipple has specified and to respond to that need is the purpose of this study. Briefly summarized, the detailed aims of the experiment have been:

I. To provide several series of Alphabetical Opposites, of high validity and reliability and ranging from very easy to a degree of difficulty which will exhaust the ability of even the ablest adult subjects.

II. To experiment with these same series on a wide range of subjects beginning with grade 4 and so on up through the grammar grades, high school, and college, including the graduate school.

* Numbers in brackets refer to references in the Bibliography, pp. 93f.

III. To determine norms and tentative standards for performances for both ages and grades.

IV. To insure future uniformity in scoring by providing a thoroughly tested and adequate Key.

V. (1) To correlate scores in the Alphabetical Opposites with scores by the same subjects in a number of the more recently developed and better known standardized tests, such as the National Intelligence, Haggerty Delta 2, Otis Advanced, Thorndike Visual Vocabulary, Kelley-Trabue Completion, and Woody-McCall Arithmetic.

(2) To correlate the Opposites with as extensive and thorough a criterion of intellectual merit as is at present obtainable by the newer methods, with the purpose of determining to what extent the Opposites Test lives up to its reputation of being one of the two or three most dependable indicators of general intelligence.

VI. To correlate scores in the Opposites Test with grades or marks in English, both for high school and college, in order to determine to what degree the Test is a measure of this special ability, and thus to determine its value as an instrument for diagnosis to the teacher of English.

CHAPTER I

THE TEST

Unless otherwise specified, the Test as used in this report means Forms A, B, C, and D of the Alphabetical Opposites. Forms f, l, r, and t were also used but with a very much smaller number of subjects. Samples of the eight forms follow. (These samples are not exact typographical reproductions.)

FORM A

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter a. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

never—always,
none—all,
perspicuous—ambiguous.

Be sure that every word you write begins with the letter a.

- | | | |
|---------------|------------------|----------------|
| 1. below | 13. negative | 25. decrease |
| 2. before | 14. retreat | 26. subsequent |
| 3. dead | 15. sluggish | 27. design |
| 4. awake | 16. professional | 28. synthesis |
| 5. present | 17. native | 29. lengthen |
| 6. subtract | 18. disperse | 30. disrupt |
| 7. different | 19. modern | 31. cathode |
| 8. child | 20. question | 32. inherent |
| 9. unpleasant | 21. law | 33. convert |
| 10. deny | 22. liabilities | 34. costive |
| 11. calm | 23. hinder | 35. canonical |
| 12. youth | 24. purify | |

[Reverse]*

WYLIE OPPOSITES TEST—FORM A

Name.....
Boy or Girl Date of Test.....
Class Born
School Age
City or County..... Score

Copyright, 1920, by Andrew Tennant Wylie
All Rights Reserved

* The title of the test and data for teacher's use appear on the reverse side of each of the eight test sheets.

The Opposites Test

FORM B

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter b. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

girl—boy,
covered—bare,
upset—balance.

Be sure that every word you write begins with the letter b.

- | | | |
|--------------|--------------|-----------------|
| 1. good | 13. noble | 25. unprejudice |
| 2. front | 14. doubt | 26. exhume |
| 3. after | 15. timid | 27. glorify |
| 4. end | 16. loose | 28. entertain |
| 5. above | 17. mend | 29. modesty |
| 6. white | 18. fertile | 30. unhackneyed |
| 7. ugly | 19. sluggish | 31. spiritual |
| 8. lend | 20. demolish | 32. malevolent |
| 9. death | 21. cultured | 33. ornament |
| 10. worst | 22. solvent | 34. intolerable |
| 11. straight | 23. injury | 35. ungracious |
| 12. praise | 24. peaceful | |

FORM C

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter c. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

storm—calm,
uneasy—comfortable,
arrange—confuse.

Be sure that every word you write begins with the letter c.

- | | | |
|---------------|-------------------|------------------|
| 1. hot | 13. effect | 25. diffuse |
| 2. go | 14. unusual | 26. continuation |
| 3. fine | 15. tragic | 27. abandon |
| 4. stop | 16. steadfast | 28. scatter |
| 5. dear | 17. reckless | 29. modesty |
| 6. sad | 18. terrestrial | 30. spiritual |
| 7. dirty | 19. lewd | 31. refuse |
| 8. straight | 20. design | 32. unrepentant |
| 9. indistinct | 21. praise | 33. unmerited |
| 10. obey | 22. informal | 34. hostile |
| 11. sane | 23. mortification | 35. cosmos |
| 12. expand | 24. unknightly | |

FORM D

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter d. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

mother—daughter,
hurry—delay,
multiply—divide.

Be sure that every word you write begins with the letter d.

- | | | |
|------------|----------------|----------------|
| 1. night | 13. hope | 25. reveal |
| 2. up | 14. creditor | 26. contract |
| 3. clean | 15. collect | 27. elevate |
| 4. alive | 16. vague | 28. recessive |
| 5. wet | 17. grow | 29. methodical |
| 6. light | 18. sparse | 30. bury |
| 7. shallow | 19. coarse | 31. conceal |
| 8. sharp | 20. safety | 32. disgusting |
| 9. near | 21. accept | 33. sinister |
| 10. easy | 22. attack | 34. evergreen |
| 11. admit | 23. unbecoming | 35. stet |
| 12. health | 24. harmonious | |

FORM f

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter f. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

head—foot,
uneven—flat,
obscure—famous.

Be sure that every word you write begins with the letter f.

- | | | |
|---------|-------------|---------------|
| 1. last | 8. unsettle | 15. unready |
| 2. slow | 9. loosen | 16. torrid |
| 3. back | 10. native | 17. honest |
| 4. near | 11. pale | 18. effective |
| 5. lose | 12. wisdom | 19. unruffled |
| 6. to | 13. lavish | 20. sterile |
| 7. mild | 14. apathy | |

FORM l

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter l. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

soft—loud,
most—least,
frequented—lonely.

Be sure that every word you write begins with the letter l.

- | | | |
|----------|-------------|--------------------|
| 1. small | 8. tight | 15. unbounded |
| 2. right | 9. cry | 16. severe |
| 3. heavy | 10. big | 17. astringent |
| 4. short | 11. slavery | 18. chaste |
| 5. find | 12. poverty | 19. Brobdingnagian |
| 6. first | 13. revile | 20. prolix |
| 7. die | 14. tidy | |

FORM r

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins

The Opposites Test

with the letter r. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

give—receive,
fair—rainy,
immature—ripe.

Be sure that every word you write begins with the letter r.

- | | | |
|-----------|---------------|-------------------|
| 1. poor | 8. unusual | 15. compassionate |
| 2. smooth | 9. unprepared | 16. exception |
| 3. fall | 10. increase | 17. urban |
| 4. square | 11. common | 18. avow |
| 5. forget | 12. cause | 19. erect |
| 6. cooked | 13. flexible | 20. communicative |
| 7. polite | 14. eager | |

FORM t

Directions. Look at each of the words in the list below. Then write a word after each one which means just the opposite and which also begins with the letter t. If you come to any word which you cannot do, then go on to the next one. These three samples are given as they should be:

head—tail,
short—tall,
important—trivial.

Be sure that every word you write begins with the letter t.

- | | | |
|-----------|--------------|---------------------|
| 1. thin | 8. doubt | 15. unwind |
| 2. loose | 9. rest | 16. celestial |
| 3. wild | 10. prompt | 17. self-indulgent |
| 4. bottom | 11. fact | 18. longitudinal |
| 5. false | 12. arctic | 19. straightforward |
| 6. learn | 13. faithful | 20. talkative |
| 7. apart | 14. languish | |

METHOD OF SELECTING LISTS AND GIVING TESTS

The device of restricting the response words by requiring that those for each series—A, B, C, etc.—should begin with a specified letter was suggested by Professor Thorndike and was adopted very largely for the reason that it would limit immensely the number of possible answers and thus greatly decrease the labor of evaluating and scoring. This device also decreased the likelihood that answers would be merely the result of simple association on the part of the subject and increased the necessity for his arriving at a solution by a process of selection and elimination from among several possible replies that would more surely test his more complex capacities and neural connections.

In determining the method of scoring—whether to allow partial scores or not—three important objections had to be considered: (1) Whether the method of partial scoring was not wasteful in the more elaborate scoring key required and the added time required for its preparation and use. (2) Whether, after all, from the point of view of statistical procedure the right or wrong

method did not yield substantially the same *total* score for each paper and consequently the same correlations, etc. (3) Whether on strictly logical grounds an opposite by definition could be anything more or less than an opposite, that is, an answer was either right or wrong and that was the end of it.

In reply the writer would answer that the test is designed to do more than merely test the ability of the subject to name *opposites*, and that in the *partially* right answers lie hints by which to judge the resources and extent of the word-hoard of the subject that in turn reveal his larger mental capacity,—that is, in some degree his “general intelligence.”

Since the purpose of this study was a great deal broader than merely to test the ability of the subject to *name opposites*, it was at first thought that it might be desirable to attempt a selection and distribution of the various words that were to make up the stimulus lists so that practically all of the more important or common pairs of opposites would be included. It was thought that such a selection if made up of a wide variety of words would necessarily make wider demands upon the subject's resources for language and thus come nearer to testing his real capacity and ability. For example, it might be worth while to select all those words from the Ayres' Spelling List of 1000 words that were pairable with an opposite or to make a similar selection from the Kent-Rosanoff list of 100 association words. The Thorndike Word Lists were not then published or this particular aspect might have been given fuller consideration.

There was also the possibility of preparing a list of words in which the elements should be deliberately selected to include a certain proportion of nouns, verbs, and qualifying words, or else, more elaborately, a list could be built up on a rather definite framework that should include words concerning color, motion, abstract and spatial ideas, moral concepts, and social relationships. It might then be presumed that such stimuli would detonate or somehow set going significant trains of ideas and stir into activity complex neural connection systems that were bound up with those fundamental and essential portions of human equipment and experience which are supposed to belong to the majority of normal beings.

However, the matter finally resolved itself into the much more informal and less philosophical procedure of devising a series of

words, each of which had a pretty well defined opposite beginning with a particular initial letter.

The first practical step in preparing the raw lists of words was to inspect the various published collections of opposites already in existence and to determine in general their length, characteristics, and the amount of overlapping or duplication of words among the several lists. Although many words from these older lists were incorporated in the present series, there is nothing significant in the fact that any particular word is included or is not included in the Alphabetical Lists.

The next step was to comb the dictionary pretty thoroughly and to prepare in alphabetical order a thousand or more pairs of words that might be drawn upon as raw material. Practically no use was made of the half-a-dozen or more dictionaries of synonyms and antonyms that are available, but nearly all the work was done directly from a *Webster's Academic Dictionary* and a *Webster's New International* (1910). At this point, as well as later on in the preparation of the somewhat elaborate Key, the *Webster's New International* (1910) was settled upon as the authority in matters of definition and spelling, with an occasional reference to the *Century*, *Standard*, or *Concise Oxford* Dictionaries.

In deciding upon the length of the several word lists it seemed advisable to extend them considerably beyond the 20-word limit used by Woodworth and Wells, Thorndike, Simpson, and others. Accordingly, a 35-word length was decided upon as a workable compromise between a much longer or a shorter list. The sole significance of 35 words is that such a number permits the inclusion in one list of a considerable range of words from very easy to very difficult ones. This procedure was decided upon rather than to make separate and distinct lists for younger and for older subjects.

It also seemed best to arrange the words roughly in order of difficulty from easy to hard and not to attempt any cyclic or other distribution of the material. The reason for this was the common sense one that young subjects would likely be the most frequently tested group and that they should be induced to try as many of the words as possible; and that their most probable method would be to begin at the beginning of a list and work forward until they were blocked by some difficulty.

The next problem was to evaluate rapidly the probable difficulty of about 1000 stimulus words and to arrange them in order. Accordingly, a list of about 1000 words was prepared and submitted to the consideration of four judges who were instructed to rank them as follows.

The judge looked at each of the words in the list and then tried to think of its opposite. After each word he next wrote a number from 1 to 10 to indicate the relative difficulty of arriving at this opposite. Thus a very easy stimulus word like *before* or *black* was rated 1, while a difficult word like *conciliatory* was scored 6 by one judge and 10 by three others. If a response came with extreme difficulty it was marked x ; and if the stimulus word was unfamiliar to the judge it was marked z . The several judgments for each word were then averaged and a rough measurement of the relative difficulty of each word was thus obtained. In so far as possible these ratings were then compared with other published lists in which the same stimulus words had already appeared and an order of presentation was arrived at for use in the actual experimentation later on.

It is readily admitted that a more refined and exact technique could have been used for the preliminary testing, but hardly one that could have been more economical of time. In view of the later results the method seems adequate for its purpose. Although the later extended experiment showed that the word lists are by no means arranged in order of regular and consecutive difficulty from easy to hard, yet it has been decided to maintain the original order for the sake of keeping intact whatever connections may exist between each word and its neighbor in the original listing. A few minor errors were corrected after the first hundred subjects had been examined. Thus the word *slow* appeared twice in the original f-list. Several slight changes were made in the sample words in the directions, and the following sentence was added in the revised "Directions" at the top of the test-paper: "If you come to any word which you cannot do, then go on to the next one."

It was not possible to secure sufficient time to try out a great number of lists on a large number of subjects. Accordingly, it was decided to use four long lists, A, B, C, and D, of thirty-five words each, these four to constitute the standard performance, and to use in addition, where possible, four other short lists of

twenty words each. These short lists (f, l, r, and t) were chosen at random from longer lists of thirty-five words already prepared, as follows. The first five words in order were taken and to these were added fifteen more taken at random. By taking the first five words of the longer lists the proportion of easy words in f, l, r, and t lists was made deliberately larger than in the A, B, C, and D, for the reason that higher scores would result for the younger subjects and the chances of an unduly large proportion of zero scores would be consequently diminished.

The time limit was arbitrarily fixed at 5 minutes each for the four long lists and 2 minutes each for the short ones. In practice this seems to provide time enough for making the long lists really measures of power. In the case of the short lists with young subjects, for example grade 4, too large a proportion of the 2-minute time allowance (sometimes as much as one half) is probably consumed in reading the directions and there is some danger that the test will consequently become in a large measure a test of ability to read. However, since there is a satisfactory scattering in the distribution of scores and not an undue proportion of zeros, it has not been thought necessary to make any special allowance for this particular difficulty.

It will be seen that, in general, complexities in technique have been waived wherever a gain in simplicity, directness, or economy of time and effort was made possible thereby. The directions for giving the tests have likewise been made as simple as possible.

Directions for Giving the Test. Pass out Form A, face down. Give each pupil one copy. Then see that pencils are ready and that every one is quiet and attentive.

Each pupil will then write his name *in full* on the line indicated and below this will fill in the blanks for class, school, date, etc. When this has been done, the teacher will say:

"Do not turn over the sheets which I have just given you until I say, 'Go.' When I say, 'Go,' turn the sheet over and read the directions. Then do just what you are told to do. If you come to any question which you cannot answer, go on to the next one.

"Now remember, read the directions. Do just what you are told to do. If you come to any question which you cannot answer, go on to the next one.

"Are you ready? . . . Go! . . . Stop, please! Turn over your papers."¹

¹ *Note:* Between the words, Go and Stop, exactly *five* minutes must elapse. After the word Go nothing more must be said until Stop.

Collect the copies of Form A quickly and pass out Form B. Repeat the directions as before. Do the same for Forms C and D.

In the case of older pupils it will be possible to save considerable time by passing out all four sheets together. Be very careful, however, that all the sheets are kept *face down* and that the tests are given in proper order, A, B, C, D. If this second method is used, after the names, etc., have been filled in, begin the directions by saying: "Now take the sheet marked Form A, but do not turn it over until I say, 'Go.' When I say, 'Go,' etc."

The directions for giving Forms f, l, r, and t are just the same as for A, B, C, and D, except that only *two* minutes each should be allowed instead of five.

In general, the time had best be taken by means of a stop-watch, although any ordinary watch will do if the experimenter is careful. As a matter of fact a few seconds, more or less, has no vital bearing on the score. However, this statement should not be construed as a license for employing a careless technique. The experimenter should be especially careful not to give any help whatever to any subject no matter how innocent this assistance may seem.

It would probably be better to precede the actual testing with a fore-exercise, although this was not done in the case of the scores reported in this study. Except through an occasional error (or where it has been noted in the case of the afternoon sections of English A and B), the lists were given in the order A, B, C, D and f, l, r, t. This order might be varied without any serious consequences to the *total* score for either set of four forms. The several forms might also be given on different days; that is, A on Monday, B on Tuesday, etc., if the examination period made this necessary.

The Key. In the preparation of the key two purposes have been kept in mind: (1) To provide a key which will readily evaluate a large proportion of all answers that are likely to occur in practice; and (2) to provide a simple scheme of grading that can readily be used by teachers who are not familiar with the giving and scoring of psychological tests. Thus there will be a fairly standardized practice and comparable results in the hands of different experimenters.

For this reason a large number of zero responses have been added. Although many of these zero answers may seem to be included unnecessarily in the Key because of their evident absurdity, yet the frequency of their appearance in practice explains their inclusion here. Nearly all of the responses listed have actually appeared, though a few answers have been added which rest on the authority of the dictionary only or else seemed likely to occur because of their similarity to genuine answers. For evaluating any other responses that may not be included here, the rules for scoring will usually be found sufficient.

The actual scoring of all papers, except those for Des Moines, was done by the author and one other person under his direction.¹

In constructing the Key the principles of scoring in so far as they could be determined from the work of earlier experimenters were considered and a few of the most valuable criteria were incorporated in the Rules for Scoring given on pages 11-13. The writer acknowledges especially the suggestions received from the King and Gold rules [3].* In determining the score to be allowed to any particular response, the following requirements were kept in mind: (1) *Has the subject followed the directions?* That is, has he given a *one-word* response beginning with the designated letter. In only a few cases was credit allowed for a *two-word* response, and never for an answer beginning with a wrong initial. (2) *Is the response an actual English word in good standing?* The authority for this decision rested with the *Webster's New International Dictionary* (1910). If a word did not appear in this dictionary it was usually rejected, although a few exceptions to this ruling were permitted in case the word occurred in some other dictionary or, like "bromidic," was apparently knocking at the door of good current usage without having quite, as yet, been invited inside. (3) *Just how good is the response?* The best responses were not very difficult to evaluate, but a very great deal of time and thought was given to the 0-, 1,- and 2-point answers, —perhaps much more time than they were entitled to. As a rule the experimenter adopted a fairly liberal attitude toward allowing partial credit for an answer that seemed to indicate some real intelligence in the mind of the subject.

¹ The Des Moines papers were scored under the direction of Dr. R. H. Franzen, at that time Director of Research for Des Moines, from keys supplied by the writer.

* Numbers in brackets refer to references in the Bibliography, pp. 93f.

In all some 5000 different responses were carefully weighed and a decision reached, usually after a rigorous comparison with the dictionary. The writer in this continually reinforced or corrected his own judgments with those of a second person who was peculiarly fitted for the task through wide reading and unusually good training in linguistics. Among the 1-point answers will be found a number of responses that are marked Obs. (obsolete). In the case of the older persons, it was reasonable enough to account in part for these answers on the ground that the subjects might often recall passages from the Bible or that they had had considerable training in English courses which had included the reading of Pope, Milton, Shakespeare, Spenser, and Chaucer and that these responses were in the nature of literary reminiscences. In the case of the younger students, however, an obsolete word usually meant an ingenious or lucky attempt at extemporaneous word-building and was accordingly given credit on the ground that it indicated "intelligence" even though that "intelligence" might be a different sort of capacity from the one which had prompted the adult answer.

In the Key which follows, some 5000 different responses have been listed and evaluated. These responses, in round numbers, are the gleanings from the 13,550 different papers of approximately 2880 subjects. Of these 2880 subjects, 2100 represented grades 4 to 8 inclusive (about 96.7 per cent boys); 315 were high school students (about 150 boys and 165 girls); and 465 were adults of whom 455 were students in Teachers College, Columbia University. Of this adult group about 88 per cent were women.

RULES FOR SCORING

I

(1) Score 3 points for the best possible response. Example: *noble—base*.

(2) In case there should be found various responses of somewhat different meanings but of equal merit, allow 3 points for any one. Examples: *hinder—allow, hinder—assist; fall—arise, fall—recover*.

II

(1) Score 2 points for a response closely allied to the best possible answer but *itself* having a much better opposite than the

stimulus word. Example: *noble—bad*. Allow 2 points for *bad*. *Good* is a much better opposite of *bad* than *bad* is of *noble*.

(2) Score 2 points for an answer which is not the best possible answer but is yet of considerable merit. Examples: *calm—angry*, 2 points; *calm—arouse*, 3 points.

III

(1) Score 1 point for an answer which is remotely opposite or only very specially, occasionally, or indirectly so; or otherwise not so good as a 3-point or 2-point answer. Examples: *peaceful—battle*, *noble—beggar*.

(2) Score 1 point for a response in which the idea is opposite in meaning but in which there is a change in the grammatical form of the response from that of the stimulus word. Example: *noble—basely*.

This rule applies especially to those cases in which the form of a verb is changed from the active to passive, from transitive to intransitive, or in which it is necessary to add a preposition to complete the sense. Examples: *purify—adulterated*, *abandon—cling (to)*.

(3) Score 1 point for an answer which is archaic, obsolete, slang, or colloquial. However, an exception may be made for an answer of particular merit. Examples: *celestial—terrenal*; allow 2 points even though *terrenal* is obsolete. *Unhackneyed—bromidic*; score 3 points even though *bromidic* is verging on slang.

(4) In general, score 1 point for a response which consists merely in prefixing a syllable to the stimulus word, such as *dis*, *anti*, etc. A score of 2 points may occasionally be allowed if the answer has some peculiar merit.

IV

(1) Score 0 for a response which is not an opposite or only very remotely so, especially where there is a change from the grammatical form of the stimulus word. Examples: *praise—bragged*; *lend—buy*.

(2) Score 0 for an answer which is an opposite but which does not begin with the required letter.

(3) Score 0, in general, if more than one word is given in the response even though the first word of the response begins with the required letter.

V

(1) But in case two or more separate and distinct responses are given to one stimulus, all of which responses are correct or partly so, the answer entitled to the lowest credit shall be the one scored. Thus, if in response to the stimulus *subtract* the answers *add* and *adding* are both given, the score allowed will be that for the word *adding* (1 point) and not that assigned for *add* (3 points).

(2) When two or more answers are given, one of which is wrong, no credit at all shall be allowed. Thus, if to the stimulus *child* the answers *adult* and *aunt* are both given, the score is 0 even though the response *adult* taken by itself is worth 3 points.

VI

(1) *Misspelling*. No deduction should be made from the score for any misspelling in the answer unless the response word is so mutilated as to be wholly unrecognizable, out of its context or extremely doubtful in context. Examples: *being* for *beginning*, *ardewood* for *afterward*. Score both words 0.

No credit should be given any answer which clearly seems to have been deliberately misspelled in order to conform to the alphabetical restrictions.

(2) *Foreign words*. Reject any foreign word (Latin, French, etc.) which is given as a response unless the word has been pretty thoroughly Anglicized. In that case evaluate the answer by the same standards as any English word.

Foreign phrases. Allow 1 point if the phrase is commonly used in English as though it were *one* word. Example: *subsequent—a priori*.

(3) *A compound word* spelled with a hyphen and conforming to the *Webster's New International Dictionary* is of course rated as one word.

Any words which are not included in the lists of words provided for scoring may be fairly evaluated by the application of the above rules supplemented with the help of a good dictionary.

Note. In the following Key certain words and abbreviations are used to indicate the status of various responses as follows: Arch.—archaic; Coll.—colloquial; Dial.—dialectic; Obs.—obsolete; N.—Does not exist as a recognized English word; Slang; Sp.—wrong spelling; Variant.

The addition of a letter or a syllable to any word listed among the responses is indicated by printing the part to be added in parenthesis, thus: *afterward(s)*, *animate(d)*, *act(ion)*, *bourgeois(e)* (ie).

ANSWER KEY—SERIES A

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. below	above aloft, atop		ahigh (Obs.)	ahead, altitude, alto ascend(ing), attic, away
2. before	aback after afterward(s)	abaft aft astern	arrear (Obs.)	about, again, ago, ahead already, always, anew, ante away
3. dead	alive animate(d)		awake	accident, alived (N), arise arose, awaken, awoke
4. awake	asleep			abed, arise
5. present	absent accept	ancient antiquity away	absence, accept- ance, afar, after, afterward(s), ago, apart, aside	advent always anything award
6. subtract	add		adding addition	abstract, after, amount attract
7. different	akin alike	allied analogous	agree agreed agress apposite associated	abnormal, absolute, about, add, addent (N), addition, adequate, adverse, another answer, appositive, asame (N), asimilar (N)
8. child	adult		adults, age(d), aman	adopt, angel, aunt
9. unpleasant	acceptable afable agreeable amiable	alluring attractive	agreeably amicable amusing	absurd, accept, admir(able) (ing), adorable, adore, ad- vantageous, adverse, affec- tionate, agree, ail, alive amorous, amuse, angelic angry, appeal(ing), appease appreciated, approved ardent, aspiring, awful
10. deny	accede, accept acknowledge acquiesce admit, affirm afford, agree allege, allow approve, assent assert asseverate, aver	acclaim assume	accuse acquiescence admission advocate affirmative affirmed agreed approved	accused, adhere, adjust administer, announce answer, appease, ask, apply assure, attend
11. calm	affected, aggra- vate(d), aghast agitate(d), agi- tation, alarm(d) anxiety anxious arouse(d) astir, awirl	action active alert alive anger(ed) annoyance annoy(ed) angry, anguish	affright(ed) afire, aflame agony, airy amazed (Obs.) araged (Obs.) assertive	abrupt, abstracted addled adverse aflight afraid, awful awkward
12. youth	age, ancient ancientry	adult	aged ancianity (Obs.)	adolescence, adolescent ageful, alder, ancestor
13. negative	affirm affirmation affirmative	absolute actual allow anode	active, agreed agreement allowed apposite assertion assured, aye	absence, abstract, add addition, aggressive, aject (N), alike, alternative anegative (N), appositive artificial, attract
14. retreat	advance approach	advent, arrive arrival, assail assault, attack	advanced agress (Obs.) arrived attacked	address, against, ahead ambush, appear, ascend ascent, asylum, attend attract, away

ANSWER KEY—SERIES A—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
15. sluggish	active agile alert animated, apt	accelerated acute alive avid	action, aflame aggressive ambitious animation astir, awake	abrupt, adequate, admire ambition, angry, apathetic assertive, attentive attractive, awkward
16. professional	academic amateur(ish)		apprentice artisan	adopt, administrator, adventurer, anti-professional, artist assistance, average avocational (N)
17. native	acquired adopted alien		acclimate(d)	aboriginal, aborigine, abroad absentee, ally, American ancestor, Arab, astrange (Obs.), away
18. disperse	accumulate aggregate amass assemble attract		accrue acquire add, align annex appear assembly associate	abolish, abscond, accept accomplish, adhere, adjoin admit, adspere (N), advance adverse, aim, ally, appeal appreciate, approach, arm arrange, arrive, assimilate attack, audience, away
19. modern	aboriginal ancient, ante- diluvial, ante- diluvian, anti- quated, antique archaic	aged	after age	A. D. advanced after Christ ante antedate anew
20. question	accept, admit affirm, agree allow, answer assert, assertion asseverance aver	assumption		accuse
21. law	anarchy		anarch anarchism anarchist	abandon(ment), act(ion) adage, advice, against, agents all, alien, amendments apothesis, arrest, atrocious atrocities, attorney, autocracy, axiom(s)
22. liabilities	assets		asset	abilities, abuses, accident(s) advantages, annuities, applications, articles, assessments assistance, avoid
23. hinder	abet, accelerate advance advantage, aid anterior assist	allow	accommodate admit, advanced afore, ahead allowed assistance	accurate, administer to advise, affect, affirm, against aggressive, allay, alone, approve, arouse, attain, attract avert, avoid
24. purify	adulterate alloy		adulterated	abase, abuse, acidify, addle adulter (Obs.), adultrify (N) annihilate, assoil, astonish atrophy
25. decrease	access(ion) accrue amplification amplify augment(ation)	accelerate, acceleration, accumulate, accumulation, add(ition), aggravate aggregation aggregate amass	accentuate accrease (Obs.) adding additional advance annex attach	abundance, abundant accreased (Obs.), acquire admit, again, allow, amount apply, ascend, ascent, assume atrophy

ANSWER KEY—SERIES A—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
26. subsequent	antecedent anterior		a priori advance afore (said) aforementioned ante (dating)	absequent (N), add(itional) accompanying, adequate, adjacent, adsequent (N), after(wards), alike, alternate, alternative, antedate, anti-subsequent (N), another
27. design	accident			abstract, advertisement, advance, advice, after, alter, annihilate, apply, arrange (ment) art, artist, assign
28. synthesis	analysis		analyze	abstract, analogous, answer antithesis, apotheosis, asyn-thetical (N), attraction
29. lengthen	abbreviate abridge	abstract	abate amputate	abandon, abduct, abrupt acute, add, adjourn, adjust after, allay, alter, alternate annex, arrest, shorten (N)
30. disrupt	amalgamate	agglutinate	adhere adjoin assemble assimilate attach	abridge, abrupt, absolve, accumulate, acquire, add, adherence, adjust, advance agreed, allay, alter, amend annihilate, arraign, arrange assist, attract, attribute
31. cathode	anode			athode (N), anthode (N)
32. inherent	accidental, acquired, adherent adjunctive adopted, adventitious, alien		absent, acquire adjunct, apart applied assumed attained	accurate, achieve, adept adhere, adverse aherent (N) asleep
33. convert	alienate apostate		adhere agnostic antagonize (Coll.), atheist avert (Obs.)	addict, adjust, adverse, advert, advise, affirm, against animadvert, argue, assimilate attain, attract
34. costive	aperient		active (Obs.) assuasive	acid, accostive (N), adductive, adhesive, afford astringent
35. canonical	acanonical apocryphal	anarchical atheistic	agnostic, anathema, anti-church, anti-ecclesiastical	abbotical (N), active, angular anticanonical (N), anti-churchly (N) apostolic

ANSWER KEY—SERIES B

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. good	bad			better
2. front	back		backward(s) behind	bottom
3. after	before			begin, begun, behind
4. end	begin(ning)		before began begun	back(ward), base, beam below, beneath, between beyond, bottom, bow
5. above	below beneath		behind bottom	back, before, between beyond
6. white	black		blackly	blue, brown
7. ugly	beautiful bonnie bonny		beautifully beautify, beauty becoming, belle benign (Obs.) brave	bad, beloved, best bold, bright, brilliant brute
8. lend	borrow		borrowed borrower	back, bear, beg, belong, bend bequeath, bequest, bereave bereft, bestow, betook bought, buy
9. death	being birth	bios	born	beauty, bedridden, before beginning, below, beneath bereave, beyond, blight breath(ing), buried, bury
10. worst	best		better	bad, beautiful, behave(d) burst
11. straight	bandy bended bent, bowed	bending broken bulged	bad, bend bias(ed), break broke	back(ward) (wards), balance base, battered, bendy, broad bum, bumpy
12. praise	blame blaspheme blasphemy	backbite becry belittle berate blackguard	besmirch blamed buse (Obs.)	bad, beg, belie, bemean, be- moan, berail (N), beseech best, besten (N), betray blackmail, bless, blow, boast- (ful), bore, brag(ged), buffet
13. noble	base blackguard	bad beastly bestial boorish bourgeois(e) (ie) brutal brutish	bachelor, bar- barous, bas- tardly (Obs.) beast, beggar beggarly blameworthy brute	backward, badman (N), ban- dit, baron, bashful, belit- tle(d), below, bickering, big bishop, boastful, bold, brave brazen, bully, bum(ish) butter
14. doubt	belief believe		believed believing	balance, begin, bethink boost, bright
15. timid	bellicose, bois- terous, bold brave, brazen bullying		big (Obs.) boastful bossy, bravery bully	backward, bad, barbarian barbarous, bashful, bewil- dered, blasé, bloody, boast bored, brawn(y), bright
16. loose	bind(ing) bound brace(d)		bagged, bal- anced, band behold (Obs.) binded, bolt(ed) bottled, bounded brake, bunched bundled, but- toned	balk(ed), bare(d), barricaded baste, beat, belong, best bestow, better, blocked, bold breakable, breakless (N) bring, broke(n), burst, buy
17. mend	break	batter burst	broke(n) bust (Dial.)	bemend (N), baste, bind blend, bore, build, burn

ANSWER KEY—SERIES B—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
18. fertile	barren		blighted	bad, bad-land, baked, bald bare, bleak, blight, boggy bracken, brackish
19. sluggish	brisk	bright, brilliant bounding, buoy- ant, busy	bubbling	bad, base, beautiful, blithe bold, bountiful, bracing brainy, bum
20. demolish	build		built	balance, bear, beautify, begin bemolish (N), benefit, bound break, build-up (N), burnish
21. cultured	barbaric barbarian barbarous barren boorish	backward Bohemian bourgeois(e) (ie) brutal brutish	bestly, bestial benighted, bluff blunt (Obs.) boor brute	backwoods, bad (ly), badly trained, baffled, bare, base beast, belligerent, bigoted boisterous, bold, bore, boyish brainless, brave, brazen, bred breed, brigandish, brusque bully
22. solvent	bankrupt broke(n)		bankruptcy	bad, baffling, base, bearing bind, brisk
23. injury	benefaction beneficence benefit, benevo- lence, better- ment, blessing boon	balm	beneficial beneficent benevolent	bail, bandage(d) befriend, bestow better, bind, break broken, bruise(d) build, burned, bury
24. peaceful	battleful bellicose belligerent blustering blustery (ous) boisterous brawling bullying bustling	battling bloody bully	babel battle bedlam belligerous (Obs.), blaring bluster brawl broil bustle	baneful, bad (ly) (ness), bar- barian, barbaric, barbarous barrage, bashful, battered battlefield, befight (N), be- lief, best, bewildered, blame- ful, blare, bleak, blighted blooded, bloodshed, blunder boasting, bolshevik (i), bol- shevist, bombardment, bomb- ing, bother(ed) (ing) (some) brazen, break, broke, brutal brutish, bulldoze, busy
25. unprejudice	bias bigotry		biased bigot(ed)	balanced, begrudge, belief believe(ing), bitterness blame, bribery, broad broadmindedness
26. exhume	bury		buried	breathe, bum
27. glorify	blaspheme	bedamn belittle bemean beshame	bemock, berate besmirch blacken blasphemy	base, beautiful(ly), beautify bedraggle, bemoan, besmear betray, bewail, blame blessed, burden
28. entertain	bore	banish	bored	bashful, beat, bemoan, best bother, burden, bust
29. modesty	blatancy, blus- ter, boast boastfulness boasting, bois- terousness, bold- ness, brag braggadocio bragging bravado brazenness		blatant, boast- ful, boisterous bold, braggart bragged brass brazen bullying	bad(ness), bare baseness, bashful(ness) beauty, base boyish(ness) braggishness (N), brave

ANSWER KEY—SERIES B—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
30. unhackneyed	banal bromidic(cal)		bromide	bad, bantered, bashful, beautifully, beset, blackeyed, blasé bold, borrowed, bothered boresome (N), boring, bound bourgeois(e) (ie), breezy, brilliant, broken
31. spiritual	beastial bestly bestial bodily, brutal brutish		base beast body	backward, bad, baleful, barbarous, believing, benighted betray, bewitched, biological blasphemous, bodical (N) body-like (N), bouquet (N) Buddhist
32. malevolent	benevolent benign benignant	beatific, beneficial, beneficent blessed	benefit benignity	bad, beautiful, beauty, befriend, belittle, blamed bountiful, brave
33. ornament	blemish blot		bare besmirch blight	barren, base, bauble, bead bedecked, benefit, benevolent blank, bleak, bracelet, bric-a-brac, burden
34. intolerable	bearable		bear (ing) beloved	bad, beautiful, becoming, behaving, belief, believable (N) beneficial, benevolent, benignant, bore, bother, broad-minded, brotherly
35. ungracious	beneficent benevolent benign benignant	bland	beatific (Obs.) beneficial (Obs.)	backward, bashful, bearable bearing, beautiful, becoming behave, beholden, beloved (N), beloved, loving (N) bending, best, better, boisterous, bold, boorish, bounteous bountiful, bright, brusque

ANSWER KEY—SERIES C

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. hot	cold	cool, chilly	calm	
2. go	come		came cease coming	call, can't, catch, caution check, close, comeback, com- mence, confine, confined, con- strain, could, cross
3. fine	clumsy coarse common crass crude	cheap	cloudy corrupt(ed)	cad(ish), calm, careful, care- less, cheat, clean, cold, come- ly, comfortable, comical, con- fection, cool, correct, cotton count, country, cranky, crazy cream, crestfallen, crooked
4. stop	commence continue	come commencement continuation	came, coming commenced commotion (Obs. and Rare) continued, con- tinuous, current	call, calmly, cannot, carried carry, carry on, catch, caught cause, caution, cease, charge chase, climb, close, comeback command, consent, creep cross
5. dear	cheap contemptible costless		common	cad(dy), calm, charming child, coarse, cold, come(ly) comrade, conceit(ed), con- tempted (Obs.), contrary cool, costly, courteous, cousin coward, crank, crazy, cruel cunning, cur, cute
6. sad	cheerful cheering cheery	comic(al)	cheer(ily) comfortable comforted comforting console (Obs.)	cajole, calm, capricious, care- free (N), clad, clear, come comedy, comfort, company complacent, complaint, con- tempted (Obs.), content(ed), (able), courageous, coy, cross cry(ing), cruel, curious
7. dirty	clean(ly), clear			comely
8. straight	confused, crisp crook'd, crooked crookt, cross crossway(s) crosswise curled, curly curved, curvy	creased crimped crinkled crossed	cripple confuse crook curl curve	clear, close, clumsy coarsed, cracked, cramped crooking, crooky, crowded
9. indistinct	clean-cut clear clear-cut		certain clearly comprehensible comprehensible	careful, chat, clean, cloudy coherent, comet, common comprehensive, concise, con- crete, confuse(d), confusing correctly
10. obey	combat command contradict	call, coerce compel conflict constrain control, cross	challenge commanded content contrary	careless, change, come, com- ply, condescend, conduct confuse, contempt, correct corrupt, criticize, crook, curse cut
11. sane	crazy	cracked crazed	crazing	calm, careless, catch, chaotic civilized, clear, clearminded (N), kleptomania, clever cloudy, confuse(d), conscious constant, convict, correct corrupt (ed), criminal, cruel cuckoo
12. expand	collapse compact compress concentrate condense constrict contract, cramp	close congest cram cringe crowd crush curtail, cut	closed confine converge crimp cuddle	calm, candy, cease, cling, col- lect, collide, collision, come- together, combine(d), com- mon, complete, compare, con- cise, conduct, congeal, con- nect, continue, convert, cover crack, cross, crumble, curve

ANSWER KEY—SERIES C—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
13. effect	cause	contravene counteract	cancel	calm, catch, cease, change circumstance, climate, cold coming, compel, complete (N), concept, conclude, con- clusion, condition, conduct conflict, confuse(d), connect consequence, constrain, con- tract, contrast, control, con- verse, counter-effect (N) countermand, corrupt, cost cure
14. unusual	common(place) constant continual conventional customary	continued continuous	commonly constantly continually continue continuously	calm, casual, chic, certain clear, coarse, coincident, com- fortable, command, confuse contrary, correct, cost
15. tragic	comic(al) comedic comedical	cheerful	comedy	calm, casual, clear, clever, co- incident, comedious (N) common(place), complacent confuse, courteous, crime cure
16. steadfast	capricious changeable changing	cowardly	change, collapse coward cowering crazy (Coll.) cringing crumbly cursory (Obs.)	calm, carefree (N), careful careless(ly), chaotic, cling- (ing), confuse(d), constant control, courageless, corrupt crestfallen, cringy (N) crooked, crumble, cunning
17. reckless	calculating careful cautious circumspect considerate	collected conscientious cool crafty cunning	care, carefulness caution, cold composed conservative controlled cowardly craftily	calm, careless, caught, char- acter, clear, clear-headed clever, collide, comfortable commonsense, confident, con- fuse(d), consistent, constant control, correct, counting courage(ous), coward, crazy crude
18. terrestrial	celestial		celestine (Obs.)	caelenian (N), caelic (N) calm, canopy, cerrestrial (N) cerulean, city, cleared, cloud (y), common, constellar (N)
19. lewd	chaste continent	cold	clean cultured (Obs.)	calm, can, candid, careful clothed, coarse, common compunctious, consecrated courteous, cunning
20. design	casualty chance contingency copy	caprice chaos confusion	casual casuality (Obs.) confuse(d) conglomeration copied	calculate, cap, caricature caution, clear, color(ed) compass, complete, compose conceal, concealment, conce- ive, conclude, consign, con- struct, construe, contract contrive, corrupt, costume creation, cunning, cut
21. praise	calumny censure, chide condemn condemnation contempt contumely criticism criticize		call (Obs. and Dial.) chasten (Obs.) chastize complain(t), con- temn, correct (ion), curse cuss (slang)	call-down (N), candor, care- less, chaff, claim, claps, com- ment, compliment, conceit concept, conditional, con- gratulated, convict, corrupt council, crazy, credit, cross cruel, culp, cursed, curtail

ANSWER KEY—SERIES C—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
22. informal	ceremonial ceremonious constrain correct	conformable conservative constrain courteous courtly customary	ceremoniously circumscribed civil cold conform(ity) courtesy custom	careful, careless, casual, catered, clear, coldly, comfortable, common(ly), concise, confident(ial), confined, conformal, congenial, cordial(ly) costume, country, course court, curt(ly), cute
23. mortification	complacency complacency conceit		calm(ness) complacent composure confidence content(ment) coolness	cheerfulness, clamor, clean comfort(able), commendation communication, composed confident, confuse, consolation, control, cool, cost
24. unknowingly	cavalierly chivalric chivalrous		cavalier (Obs.) chivalrously chivalry courteous(ly) courtly	callous, casual, cautious character, civil, cloddish comely, commendable, common(ly), commonplace, correct, courageous, courtesy crowned, cruel, cultured
25. diffuse	coagulate(d) collect(ed), collective, compact compress(ed) concentrate(d) concise condense(d) congest(ed) contract(ed) converge	center centralize combine constrain(ed)	centered clarify (Obs.) clear (Obs.) collectively combined confine(d)	cling, commensurable, complete, conceal, concrete, confuse, connect(ed), conserve(d), construe, consume, continue, control, convene, correct, correlate, correspond
26. continuation	ceasing, cessation, check close, closing completion concluding conclusion culmination	cancellation contraction curtailment	cancel, cease(d) change, closed collapse, complete(d), conclude(d), contract, culminate(d), curtail cut(ting) cut-off, cut-out	carry, clogging, coming commence, concise conglomeration, constant(ly), cut off, cut short
27. abandon	champion cherish claim constraint	cleave cling cohabit conserve continue	calm(ness) capture, care catch, coddle comfort (Obs.) commence commit company(Arch.) complete, conduct, contain continued	cared, care for, careful, caring carry, cease, chase, close, collect, combine, come, coming command, commander, compose, conclude, congregate connect, conquer, console constant, consume, contact contract, control, cooperate cops, cover, correlative
28. scatter	centralize cluster, coagulate, collect combine commingle compound concentrate congest, congregate conjoin, consolidate, converge	catch close compose confine contract crowd	capture collected compile (Obs.) congregation connect conserve convene crowded	call, carry, chase, clean(ed) clear, closer, collide, come come together, command complete, conceal, confuse confusion, construct, consume, contact, contain, continue, contribute, correct cover
29. modesty	coarseness conceit	cheek (Coll.) coquetry	coarse conceited	callous, candid, candor, careless(ness), character, chastity common, corruption, courteous, courtesy, coy, cowardice cranky, craziness, crudeness curiosity

ANSWER KEY—SERIES C—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
30. spiritual	carnal corporeal	carnate coarse concrete	cosmic	callous, canonical, caustic celestial, Christian(ity), clerical, clay, commercial, common(place), contact, content courtesy, covetous, coward criminal, crude
31. refuse	cede comply concede consent		clean, complied conceded concur (Obs.) condescend confess, conform coincide consider	call, came, care. certain(ly) certify, claim, collect, come command, comment, compel comply with, confer, confirm confuse, confusion, contribute convene, correct, could
32. unrepentant	contrite	compunctious converted	chastened compunction contrition convert corrigible	calctrant, care, ceremonial chagrined, chastised, compensation, compentant (N) concede, conciliatory, condescending, confess, confessing, confession, confessional confirmed, conforming, conscience, consciencestricken (N), conscientious, contrivant (N), convertant (N) convertive, corrected, credulous, criminal
33. unmerited	condign			cherished, claimed, clever collected, commendable, commended, commerted (N) committed, complimented confident, considered, credit(able) (ed)
34. hostile	companionable comradely conciliatory confederate congenial cordial	compatriot	chum civil clannish companionship comrade courteous	calm, carry, casual, cautious charitable, charming, chums civilized, commercial, company, complacent, confident contented, cool, cooperate cooperation, courageous coward, crude, cultured cunning
35. cosmos	chaos	confusion	celestial chaotic confuse	caelae (N), caelum, calm center, clean, common, contour, cool, coreopsis, corner cosmopolitan, country

ANSWER KEY—SERIES D

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. night	day, daytime	dawn, daylight	daily	dark, dusk
2. up	down downward(s)			
3. clean	dirt, dirty	dust, dusty		dreary
4. alive	dead deceased	drowsy	death, die died, drowned	drown
5. wet	desiccated dried, dry			damp, drip, drown
6. light	dark (ness) dusky	dim dull	dreary (Obs. and Arch.)	day, distinguish
7. shallow	deep	depth		dark, dense, dim, dirty, dun
8. sharp	dim dull	dense drowsy	dead dumb	deadening, deaf, deep, de- faced, dented, dragging, dusty
9. near	distant	depart	departed distance	dear, delay, disappear diverse, down, dump
10. easy	difficult		difficulty discomfort	dangerous, daring, deep dense, desperate, devilish disastrous, disturb, doubtful dreadful, dreary, dull
11. admit	debar, deny deport, disallow disavow, disbe- lieve, discharge disclaim dismiss disown	demit (Obs.) dispute	decline defend (Obs.) deliver, demur denied, differ disagree, disre- spected, disre- gard, dissent doubt	deceive, decrease, deduct delay, defy, demitted, de- nounce, depart, depose, de- prive, deter, devenir, disclose disobey, dispossess, down
12. health	disease	debility decay decline disable delicacy delicateness	danger, de- cayed, delicate disable diseased diseaseful	dead, death, decrease, defect- (ive), deform(ity) delin- quent, destruction, dirt(y) disability, distress, dying
13. hope	despondence despondency despair distraction distrust dread	dejection depression desperation discouragement disheartenment dismay downhearted- ness	dejected, depress desperate despondent discourage (d) dishearten dispirited doleful doubt downcast downhearted	damned, danger, dead, death deceive, decline, decrease, de- feat, defy, degenerate, deny deplore, desire, destiny, de- stroy, die, disaster, disap- point, disgrace, disgust, dis- illusioned, disparage, despise distress, doom, downfall(en) downheart, dreadful
14. creditor	debtor	discreditor	debit, debt discredit	decreditor (N), deditor (N) depositor, director, destroyer
15. collect	decompose deliver, diffuse disband, dis- burse, discharge disintegrate dismiss (Rare) dispel, dispense disperse, dispose disseminate dissipate, dis- tribute, divide	demobilize discard dissolve	defray (Obs.) delivery divy (Slang) donate	debit, debt(or), deceive, de- crease, deduct, defer, deficit defraud, delay, dellect (N) demand, demit, demolish, de- organize, deport, depose, de- posit, deprive, destroy, de- tract, disarrange, discollect discontinue, discount, disor- ganize, disregard, dissemble donation, down, drop, due dun

ANSWER KEY—SERIES D—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
16. vague	decided decisive definite detailed distinct	direct	defined described descriptive detail determined distinguishable	dark, deaf, deceive, deep dense, derisive, describe, dim dispel, distant, distill, dreadful, doubt (ful), doubtless diverse, dreaming, dull
17. grow	decay, decline decrease degenerate deteriorate diminish dwindle	decease depreciate die	dead, death decreasing destroy, died dying (Sp.) dormant, droop dwarf (ed), dying	damage, deform (ed), degrade delay, demolish, depress, descend, desist, detract, develop digression, disappear, disintegrate, doubtful, down draft, draw, drop
18. sparse	dense		densely density	damp, dead, dearth, detain develop, diffuse, diverse
19. coarse	dainty delicate	deft distinguished	decent diminutive	dandy, dear, definite, delay delicious, delightful, dextile (N), diffuse, dignified, dim distinct, distinguish, divided divine, downy, dull
20. safety	danger	destruction distress	damage, dangerous, destroy destructive disaster	dare, deadly, death, depart desperate, difficulty, disastrous, distrust, doubt (ful) dreadful
21. accept	decline, deny disavow disbelieve discard disclaim discredit disdain dishonor donate, disown	discount dispute disregard	declined, denied deject (Obs.) denounce disacceptance disagree disapprove dismiss disprove doubt	deceive, deceive, defer, define defrain, defy, delay, deliver delude, demand, demolish deport, depose, deposit, depress, deprive, desist, despise, destroy, deter, disaccept, dispel, disperse, dispose dissatisfied, distribute, divide do
22. attack	defend defense		decamp defect (ion) defensive desert (ion) detract (Obs.) dispel, dispersal disperse dissipate	dare, deadly, decrease, default (er), defy, defeat, define delay, deliver, demobilize, denounce, deny, depart, deploy desist, detach, disarm, disband, discharge, dismiss draw
23. unbecoming	decent decorous	dignified	dainty deserving desirable	dandy, dangerous, darling dear, décolleté, decorative delectable, delicate, delightful, disgraceful, distinctive dreadful, dressy, dutiful
24. harmonious	discordant dissentient disharmonious dissentious dissonant	deranged discomposed disjointed disorderly dissenting disturbed	disagreeable discomposing discord (ance) discording disjoined disharmony disintegrated disorder disquiet (ing) dissent distracting disturbing	dangerous, deadly, deafening defective, degrading, desolate diffused, disagree, disastrous disgusting, disrupt, disrupting, distasteful, distracted doleful, doubtful, dreadful dreary, dull
25. reveal	disguise	darken	disappear	deceit, deceive, decline, decree, decoy, defer, delay, deliver, delude, demolish, demonstrate, denounce, deny describe, desist, destroy, detain, detect, deter, diffuse disclose, discover, display dispose, disreveal (N), dissolve, divide, divine

ANSWER KEY—SERIES D—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
26. contract	dilate discharge dissolve distend	disagreement disengaged disperse	develop disagree diffuse (Obs.) disband (Obs.) distract (Obs.) divorce (Obs.)	debate, decrease, demur, deny depart, derive, detract diminish, disband, disclose dismiss, dismissal, disobey dispel, dissociate, distribute divide, divulge
27. elevate	debase decline degrade depose depress deteriorate drop	decay demote dethrone	declivate, defile degenerate (Obs.), degrading (Obs.), deject (Obs.), depend depreciate, de- pression, derog- ate, descend descent, detract down(ward) downfall downing	decrease, deduct, deepen deflate, deliver, deplore destroy, deviate, depth diminish, divide, dominate drag, dumbwaiter
28. recessive	dominant			daring, decessive (N), de- cided, decisive, delay, demon- strative, depressive, digress- ive, disclosive, distract diverge
29. methodical	deranged desultory disarranged disconnected discursive disjointed disordered disorderly	dilettante disorganized	dilly-dallying disarrange disarray disarrayed disorder	diabohical, deism, delaying devilish, dilatory, discontin- uous, discussion, dishevelled disillusioned, disrupt, dis- tract(ed) (ing), distraught divergent
30. bury	disentomb disinhume (Rare) disinter	deliver dig	detect dig out dig up disclose discover display, divulge	dance, dead, death, decay delve, demolish, deposit deter, die, disgorge, dishume (N), disintegrate, dislodge displace, draw out, drop drown, dug
31. conceal	develop, detect disclose discover display, divulge		define, demon- strate (Obs.) disclosing disrobe	deceive, declaim, denote denounce, deposit, desert dismantle, dispose, divide
32. disgusting	dainty delectable delicate delicious delightful delighting	desirable	delight(ed) desirous (Obs.) desired	darling, dear, decent, degrade disagree(able), disgraceful disheartened, displeasing displeasing, displeasure dreadful
33. sinister	dexter		dexterity dexterous (Obs.) dextrous (Obs.) direct	dangerous, damn, deceive delicate, delightful, dextra dim, disarming, divine droit
34. evergreen	deciduous			daffodil, daisy, dandelion darkest, death, decadent decay, deer, die, different dingy, diurnal, drab, dreary dried, dry, dull, dying
35. stet	dele, delete		destroy	debt, durby (Sp.)

ANSWER KEY—SERIES f

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. last	fade, fail first, foremost	fore, forwards front		further
2. slow	fast, fleet			
3. back	face, fore, forth forward, front	first		
4. near	far, *far-away *far-off		from further	far away far off
5. lose	find		found	fast(ened), firm, foul
6. to	fro, from			for, fore
7. mild	fearful, fero- cious, fierce forceful, forcible fractious furious	firm, frantic freezing frenzied, fresh frigid frosty	fatal, fiery formidable forward, freeze frenzy, frost frozen, fury	fair, fast, fear, fearless, fervor fine, foggy, freezed (N) frighten, frivolous, frown
8. unsettle	fix found	form	fair fasten (Obs.) fine (Obs. and Rare), firm(ly) fixed, formed	fast, favorable, ferment fettered, fidget, finish(ed) florid, fulfill
9. loosen	fasten fetter fix	fold	fast(ened) fettered firm, fixed	force, flat
10. native	foreign(er)			
11. pale	fiery, flaming flare, florid flush(ed), fresh		feverish	fade, fair, fat, fine, fleshy flourished, floriant (N)
12. wisdom	fancy, fatuity fatuousness folly, foolery foolishness		farce falsehood falseness fool(ish)	faith, false, fooly (N) forgetfulness
13. lavish	frugal	forbear	few	foolish
14. apathy	feeling, fer- vidity, fervor frenzy, furor	fury	favor, fervid feverish, force freshness	faith, favoritism, fear(less) fondness, freedom, friendli- ness, frolic
15. unready	facile, fit forehanded	finished forewarned	finish, fixed foresee (Obs.)	fast, first, fix, foremost free
16. torrid	frigid, frozen	freezing, frosty	freeze, fresh	
17. honest	faithless, false foxy, fraudu- lent, furtive	foul	fake(r) fickle (Obs.) fraud, faulty	fib, financier, free foolish, forger, forward frank
18. effective	frustrative futile	faulty feckless, feeble	failing, failure frustrated	fatuous, figurative, foolish frightful, frivolous
19. unruffled	flurried flustered fluttered fluttering frenzied furious fussy	feverish flighty fretful	flounced frumpled (Obs. and Dial.) fluster flustered frenzy, frilled frowzy, fussed	fancy, fearful, feathered firm, fixed, flounce, flushed fluted, foolhardy, frightened fringed, furred
20. sterile	fecund, fertile fruitful	fertilized		ferment(ed), filth(y) foul

*(Allow full credit for "faraway" or "faroff" when spelled as one word.)

ANSWER KEY—SERIES 1

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. small	large			least, lengthy, little, long, lot
2. right	left			
3. heavy	light			large, loose
4. short	lengthy long		lanky length(en), lofty	large, lumpy
5. find	*loose (Sp.) lose		leave lost	long, look
6. first	last, least			
7. die	live		life, lived, living	lie, linger
8. tight	loose *lose (Sp.)		loosen	large, light
9. cry	laugh		laught (Obs. and Dial.) listen	languid, languish, lisp, lull listence (N)
10. big	little		lean	least, less, light, limit, long
11. slavery	liberty		license lordship	laymen, lazy, leisure, liber- ality, lordly, love, luxury
12. poverty	luxury luxuriousness	lavishness	largess (Obs.) lavish, liberality livelihood lots (Coll.)	lasting, laxliness (N) leisure, liberalism, life, loot lucrative ^{ness} , lust
13. revile	laud			lift, like, limit, livable, listen lonesome, love(ly), loving lure
14. tidy	litter(ed) littery		loose	labyrinth, lackadaisical, lax- (ative), lazy, leave, liberal lousy, lude (N)
15. unbounded	limited		limit	laced, lasting, lashed, leased leashed, leave, liberated, li- gate, limitless, line(d), little locked(up), loose(ned)
16. severe	lax, lenient light, lively	liberal, loose loving	large (Obs.) laxity, lightly	languid, laud, laxative leniel (N), lovable
17. astringent	lax laxative, lenient	loose loosening	loosen	laissez-affaire, leave, leech license, limpid, lubricant
18. chaste	lascivious lecherous, lewd libertine libidinous licentious loose, lustful		loud lurid lust	lax, level, loosen, low
19. Brobding- nagian	Lilliputian		Lilliputia little	
20. prolix	laconic			limited, lentex (N)

*Regard as misspelled, but give full credit.

ANSWER KEY—SERIES I

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. poor	rich			ripe
2. smooth	ragged, ringed rough, rought ruff (Sp.) ruffle(d)	ridged	rocky	*rinkle (N)
3. fall	recover right rise	rear revive	raise reanimate reinvigorate righten (Arch. and Dial.), rose	rain, reach, rebuild, remain remove, rescue, rest, retain retard, ride, river, roll, run
4. square	ring, round			rectangle, rectangular
5. forget	recall, recollect remember		remembered remind	recover, renew
6. cooked	raw, "rawr" (Variant)		rare, "rear" (Variant)	regular, rigid, ripe, roasted round
7. polite	rude	rough, rowdy		rash, repulsive
8. unusual	regular	recurrent, recur- ring, repeated representative routine	regularly rule	rare, rational, real, right
9. unprepared	ready	rehearsed	readiness responsive	raw, refined, remain remember, repaired
10. increase	reduce reduction relax restrict	retard	recide (Obs.) reduced restrain	rarity, recede, recessional recided, recline, release, relin- quish, rescind, retract retrieve, revile
11. common	rare refined remarkable		refine, regal respectable rich, royal	real, recluse, regular reticent
12. cause	result	reaction	repeal	reason, refuse, remains remedy, root, repair resolution
13. flexible	rigid	reluctant resistant resisting resistive	ramrod(dy) (Coll.), resolute resolved restrained	ramrod, reflex, reflexible restricted, rusty
14. eager	reluctant repressed reserved restrained	retiring	resist resistant resisting reticent	refrain, regretful, resigned restive, restless, retard ridiculous, rude
15. compassion- ate	relentless remorseless ruthless		regardless repellent	rational, refuse, remonstrate resentful, resigned, resistant resolute, restful, restraint rigorous, rough, rude
16. exception	rule	regulation	regular regularity	rare, rarity, reception refuse, rejection, review
17. urban	rural	rustic	rough (Obs. sense)	resident, round
18. avow	recant, renounce repudiate retract		refuse, reject †renig revoke (Obs.)	ratify, recognize, refrain refute, resolve, respond revenge, revise, reward

*While this may be regarded as a misspelling of *wrinkle* it cannot be given credit since *wrinkle* is spelled with a *w*.

†(Colloquial variant of *renege*.)

ANSWER KEY—SERIES r—(Continued)

Stimulus Word	Score 3	Score 2	Score 1	Score 0
19. erect	raze, recline(d) reclining recumbent		reduce, remove roundshouldered ruin	rear, reconstruct, revive rigid, rip, round(ed) rounded over
20. communi- cative	receptive reserved reticent retiring		repressed reserve retentive (Obs.) retired (Obs., Rare) retractive	recessive, reciprocal, re- cluse, reclusive, reflective, re- luctant, repulsive, resolute responsive, restful, restricted restrictive, reticive (N) retreating, ruptured

ANSWER KEY—SERIES t

Stimulus Word	Score 3	Score 2	Score 1	Score 0
1. thin	thick			tall, torn
2. loose	taut, tauten tense, tie(d) tight(en)			taunt, together, tried twine
3. wild	tame(d) tractable	temperate trained	timid	
4. bottom	top	tip		
5. false	true, truthful		truth	
6. learn	teach, tell, tutor		taught	
7. apart	together	touching	tied, touch	tight, time, toward
8. doubt	think, trust			tell, testify, true, truth
9. rest	tire, tiredness toil, travail travel, trouble	turmoil	tired troubled turbulent	tense, toss, tramp, try
10. prompt	tardy, truant		tardiness	tarry, tawdry, tolate (N)
11. fact	theory		thought tradition	tale, truth
12. arctic	torrid, tropic(al)		tropics	temperate
13. faithful	traitorous treacherous truant(ly) trustless		traitor tricky trifling	tedious, traitor like, trick true, trustful
14. languish	thrive			tighten, tongue, turbulent
15. unwind	tangle (Rare) twine, twist	turn twirl	tighten	taut, tie, tie up, tight, thread turn back
16. celestial	terrene terrestrial	terrenal (Obs.) temporal	terra firma	terre, territory
17. self-indulgent	temperate		temperant(Obs.)	thoughtful, thrifty
18. longitudinal	transversal transverse			latitude, latitudinal terretudinal (N)
19. straight- forward	temporizing tortuous, tricky		treacherous trickster	tactful, timid, timidity turning, twining
20. talkative	taciturn	tacit, terse tongue-tied	tight (Coll.)	tacitus, tactful, tentative timid, tight-mouthed (N) thoughtful

CHAPTER II

THE POPULATION TESTED

With the purpose of trying out the Alphabetical Opposites on as many different sorts of subjects with as wide a range in age and ability as possible, the tests were applied to a somewhat numerous and varied population.

1. *Garden City*. The subjects here were the pupils in a small but well organized suburban school on Long Island, a few miles from New York City. The social environment of most of the pupils was distinctly above the average, although there were included children from less favored homes. In all, there were examined 125 subjects apportioned among grades 4 to 8 as follows:

TABLE I
OPPOSITES POPULATION BY GRADE AND SEX
GARDEN CITY

Grade	4	5	6	7	8	Total
Boys	19	18	14	10	4	65
Girls	15	18	9	6	12	60
Totals	34	36	23	16	16	125

Not all of the 125 took all of the tests, but the general plan of the examination was as follows: February 17, 1920, A, B, C, and D (in order) were given by the writer and the school psychologist. March 23, l, f, r and t (in order) were given by the school psychologist. On June 11 and 14, A, B, C, and D, and t, r, f, and l (in this order) were again given by the school psychologist.¹

2. *Public School 64*. Public School 64 is a large East-side school in the Borough of Manhattan located on East 9th Street.

¹ For the June A, B, C, D, 3 minutes apiece, instead of 5, were allowed, but the scores were compensated for empirically by adding 10 per cent to the 3-minute score. In grade 8 in the March examination, through an error, 1 minute instead of 2 was allowed for the r-list. The list was immediately given a second time with a 2-minute allowance and the scores on the two trials compared. For the 16 pupils tested, there had been an average gain of only 3.3 points apiece in the total score. This would indicate that a certain laxness in time-keeping will not invalidate the test. However, the writer does not advocate giving the test except under standard conditions.

The pupils are mostly the children of Jewish immigrants with a smaller proportion of Italians and Poles. A very thorough and extensive survey of the entire school was made during April, May, and June, 1920, including the application of a number of standard tests. The Opposites A, B, C, D were given May 18. It was accordingly possible to obtain many scores in a great many tests, including the composite score of the 6-test Criterion described later in Chapter IV, and thus to subject the Alphabetical Opposites to a rather unusual competition.

The actual testing was done by the various classroom teachers. The order of the tests was A, B, C, D except in a few cases where, through an error, another order was adopted. The total number tested were as follows:

TABLE II
OPPOSITES POPULATION BY GRADE

PUBLIC SCHOOL 64							
Grade	4	5	6	7	8	Anemic	Total
Number	192	448	407	481	416	45	1989

The arrangement by classes was:

TABLE III
OPPOSITES POPULATION BY CLASSES AND GRADES

PUBLIC SCHOOL 64							
Grade	4	5	6	7	8	Anemic	Total
Classes—							
Regular (or Academic)	5	11	10	5	4	2	37
Opportunity	0	1	1	2	2	0	6
Prevocational	0	0	0	6	6	0	12
Total	5	12	11	13	12	2	55

Only 31 of the above population were girls: 14 in grades 4B to 5A; 13 in grades 6B to 7A; and 4 in grades 8A to 8B. A 4B to 5A class was tabulated as a fifth-year class, and a 6B-7A class as a seventh-year class. The Anemic classes included pupils from grades 4, 5, 6, and 7, and one pupil from grade 3.

From the 55 classes, 27 were selected to form a Criterion Group. The group was so designated for the reason that for about 700 of the 1107 pupils enrolled in these 27 classes, it was possible to compute an index number, or criterion score, based on their performance in the six tests that composed the criterion. This criterion and the six tests are described further on page 50.

Of the 1107 pupils enrolled in this group, 953 also took the

Opposites Test and from these 953 were selected the Opposites scores that were used to obtain the correlations of Chapters IV and V. In order that the various correlations for the Opposites described in these chapters might be directly compared with those reported by Dr. Stenquist on page 56 the writer was careful, in picking Opposites scores, to select them class by class so that they would be approximately proportional in number and kind to the scores used by Dr. Stenquist. Thus, while it was not possible for the writer to use exactly those same individuals in correlation for the Opposites that were used in *each* of the several correlations described on page 56, still the two series of correlations may be fairly compared with each other for the reasons that (1) all cases were drawn from the same *total* population; (2) the two series overlap each other; (3) and care has been taken that no one age or grade shall by chance exert an undue weighting on the whole result.

3. *Julia Richman High School Annex.* This group consisted entirely of girls in the Julia Richman High School Annex, 102nd Street and Amsterdam Avenue, New York City. This school provides a five-term commercial course extending over two and one-half years. The pupils selected for this experiment were drawn from all five terms of the school course and examined in four groups, during school hours by the writer May 21, 1920. All were given the tests in the order A,B,C,D; and a few were given in addition f, or f and l.²

The distribution by terms of those taking the test was:

TABLE IV
OPPOSITES POPULATION BY TERMS
JULIA RICHMAN HIGH SCHOOL ANNEX

Term	1	2	3	4	5	Total
Number	63	5	51	36	10	165

4. *High School of Commerce.* The members of this group were all boys enrolled in the High School of Commerce on West 65th Street, New York City. The school offers an eight-term, four-year course, the subject matter of which is discussed in some detail in Chapter IV. The forms A,B,C,D were given to

² One group of 45, through an error in the time allowed for Series B, ran over the time one minute. These papers were each penalized 10 per cent of the score for B. While this penalty was somewhat arbitrarily arrived at, it is probably not far from the true correction. The score does not increase directly as the time; consequently a penalty of one-sixth would have been too high, and one-tenth was taken as a fair compromise.

126, and f, l, r, t to 36 others. The testing was done by the writer during school hours June 8, 1920.³

The number examined were:

TABLE V
OPPOSITES POPULATION BY TERMS
HIGH SCHOOL OF COMMERCE

Term	1	2	3	4	5	6	7	8	Total
Number	0	1	83	22	4	0	7	36	153

The number finally usable for A, B, C, D were:

TABLE VI

Term	1	2	3	4	5	6	7	8	Total
Number	0	1	49	17	2	0	7	34	110

5. *English A and English B.* The subjects for this portion of the experiment were students in the School of Practical Arts, Teachers College, Columbia University, and were all enrolled either in English A (freshman English) or English B (sophomore English). However, this does not mean that all students so classified had first or second year standing in all of their other college work, since a number of juniors, seniors, and unclassified students were also enrolled in one or the other of these two courses. There were examined in all, six sections of English A, of whom 98 per cent were women; and seven sections of English B, of whom only 3 per cent were men. The table following shows the numbers and college rating of those taking test.

TABLE VII
OPPOSITES POPULATION ENGLISH A AND B
TEACHERS COLLEGE

Class	English A	English B	Total
Freshman	141	2	143
Sophomore	12	69	81
Junior	3	33	36
Senior	0	30	30
Unclassified	15	44	59
Not Given	3	5	8
Total	174	183	357

³ In the case of a number of boys, chiefly in the third and fourth terms, it was found necessary to cut the time allowance for Series D from 5 minutes to 2½ minutes. In order to make these scores fairly comparable with those of the rest of the school, a score was recorded for D for 32 of the papers which was for each individual .4 of his A, B, C score. This .4 was determined by averaging the scores of 75 other A, B, C, D tests that had been taken under standard conditions in the other classes. The result was: $D = .387 \times A, B, C$.

The tests were given April 30, 1920, part in the morning and part in the afternoon. This fact has no significance except that the order of the tests in the morning was A, B, C, D, f, l, r, t, and in the afternoon, D, C, B, A, t, r, l, f.⁴

6. *Education 456 A.* The members of this group were students enrolled in the course on Mental and Vocational Tests and Treatment of Results. They may be described as a group of superior adults with professional interests. Those taking the tests included 15 men and 14 women. The tests were administered by the writer on two different days. On March 25, 1920, A, B, r, and t were given; and on April 8, C, D, f, and l.

7. *The Thorndike Six-Hour Group.* This group for convenience will be designated as the Thorndike Group for the reason that the members composing it were subjected by Professor E. L. Thorndike to an unusually searching series of tests and examinations covering a wide range of abilities and lasting about six hours in all. The Thorndike tests were given during December, 1920, to 57 persons, of whom 49 also took the Alphabetical Opposites A, B, C, and D. These persons were students taking part or all of their work in the School of Practical Arts, Teachers College, and with two exceptions had been in attendance both semesters, that is, for the academic year September, 1920, to June, 1921.

It is not possible to state here exactly the precise class-rating and major interests of the 49 individuals who took the Alphabetical Opposites Test, but such information was obtained for 49 persons of the 57 constituting the Thorndike Group, and it is reasonable to suppose that the college classification and interests of these 49 sufficiently resemble and overlap the 49 who took the Opposites Test to be taken as representative of them as well. (See Table VIII.)

The characteristics of the group of 49 may be briefly stated thus: adult persons of varied interests and on the whole somewhat undefined academic standing; college courses largely

⁴In giving the l-list to a group of 83 pupils in English A, the 2-minute period was allowed to run over to 3 minutes. These 83 scores were compensated for in the records by reducing each score 10 per cent. This correction was got as follows: Sixty cases of the 83 were chosen at random and averaged with a result of 39.9. Sixty other cases were then chosen at random from the remainder of the English A groups and averaged with a result of 35.7. Other factors assumed to be equal, the difference 4.2 (or 10.5 per cent of 39.9) therefore represented the probable additional gain in the score of the l-list due to overtime.

TABLE VIII

OPPOSITES POPULATION—THORNDIKE GROUP

RATING AND MAJOR INTERESTS

College Rating		Major Interests	
Unclassified	28	Some Phase of the Work in	
Not Matriculated	5	Nursing and Health.....	34
Freshman	0	Physical Education.....	1
Sophomore	1	Fine Arts.....	1
Junior	9	Educational Administration.....	1
Senior	0	Mathematics	1
Graduate	6	Cookery	1
		Religious Education.....	1
Total	49	Household Arts Education.....	2
		Teaching	2
		Education	3
		English	1
		Not Stated.....	1
		Total	49

professional in character, and many of them of a highly technical nature.

8. *English Experts*. Series A and B were given to 10 experts in English and the unsigned papers afterward paired by handwriting. These 10 subjects (all men) were specialists in English and included several heads of departments in New York City high schools, two or three college professors and one well-known publisher, formerly an English professor. In spite of the limited scope of the experiment, several interesting deductions were possible from the results. These are reported in Chapter V.

9. *Des Moines*. Series A, B, and C were also given to about 12,000 pupils in the Des Moines, Iowa, school system.⁵ The pupils included about 80 per cent of the 3 A's (the upper half of the grade) and all others above that point through the high school. Those omitted from the testing were pupils enrolled in private or parochial schools and truants from the public school system. The results have thus an unusual value for two reasons: (1) Practically the entire 4th to 12th grade population is included and the distribution consequently approaches a true normal distribution. (2) A group of this sort drawn from a

⁵ These Opposites were administered and scored under the supervision of Dr. Raymond Franzen, formerly Director of Research for Des Moines. It is through his courtesy that the results are presented here.

typically middle-western community is presumed to be freer from the supposed language contamination and attendant verbal disability of communities with a large infiltration of non-English-speaking persons, such as New York City is at the present time. Such a group as the Des Moines system, therefore, serves as a check on New York City norms and averaged with them presumably approaches the country-wide average of the United States taken as a whole. For the distribution of Des Moines see Table XLVIII. For a detailed discussion and interpretation of the Des Moines Opposites, see References 7, 8, and 9 in Bibliography, page 93.

Additional Material. The Alphabetical Opposites have also been used by the Classical Association for their inquiry regarding ability in high school Latin. Some 470 complete sets for A, B, C, D, and f, l, r, t were given in the Brooklyn, N. Y., school system in the fall of 1921 by Dr. W. S. Allen. For a complete analysis of these results, see Reference 10 in the Bibliography.

The test has been used as part of an important analysis by Professor E. L. Thorndike of the mentality of students in the Columbia Law School, and has also been incorporated as a part of his well-known "I. E. R. Test of Selective and Rational Thinking." For an account of this last, see Bibliography, References 11 and 12.

CHAPTER III

THE RELIABILITY OF THE TEST

By the reliability of a test is meant the consistency of performance, or stated in another way it is "the amount of agreement between results secured from two or more applications of a test to the same pupils by the same examiner."¹ The amount of this agreement is usually expressed by finding the Pearson r between the scores of the first application of the test and those of the second. However, the exact conditions laid down in the quotation above cannot always be met precisely. The two applications of the test may be made by different examiners, or, what is often the case, it may not be possible to give the test more than once. In the latter contingency, a measure of the reliability of the single operation of the test is obtained by a second method of self-correlation, that is, by correlating the random halves of the test with each other just as though they were two separate and distinct tests in themselves. The correlation which is thus obtained between the two halves of the test may be further operated upon by the application of Spearman's formula and a result obtained which is the reliability coefficient for the *whole* test.²

The reliability of a test is thus measured by the magnitude of the Pearson r and by the magnitude of the coefficient obtained through the aid of Spearman's formula (or "Brown's formula"). While the whole story of reliability may not be thus condensed into a single per cent or decimal, still the absence of a relatively high coefficient seriously impugns the integrity of the test; and, on the other hand, its presence warrants a confidence on the part of the examiner in the probable value of the test as an instrument of psychological diagnosis.

¹ McCall, W. A., *How to Measure Education*, p. 307

² This particular application of the Spearman formula is frequently referred to as "Brown's formula." For a more detailed discussion of this use of Spearman's formula see the references under Statistical Methods, Chapter VII.

Both of these methods were made use of in determining the reliability of the Opposites as follows:

1. *Garden City.* The total score made in February for Series A, B, C, D for each of 76 pupils in grades 4 to 8 was correlated with the score for A, B, C, D made by the same 76 pupils in June. The resulting r was $.812 \pm .027$. (See Table XI.) In the same manner the scores for the same 76 pupils for Series f, l, r, t for March were correlated with the f, l, r, t scores for June. The r obtained was $.832 \pm .024$.

Next the self-correlation was determined by breaking up the A, B, C, D scores into two halves: A, B and C, D. The A, B for February was correlated with the C, D for February and the A, B for June with the C, D for June. Resulting r 's were: $.808 \pm .028$ and $.906 \pm .014$. The same population of 76 pupils was used as before.

The reliability coefficient for the entire A, B, C, D for February was then obtained from the r of its two halves by the application of Spearman's formula thus: In the formula

$$r_x = \frac{n(r_1)}{1 + (n - 1)r_1}$$

r_x = the reliability coefficient to be obtained for the *whole* test, that is, for the first half plus the second half.

r_1 = the r actually obtained between the two halves of the test—in this particular case, .808.

n = the number of times the test is given; here considered as 2 since A, B and C, D each represents one-half of the test given once.

Substituting in the formula we get:

$$r_x = \frac{2 (.808)}{1 + (2 - 1) .808} \times \frac{1.616}{1.808} = .893$$

That is, the Coefficient of Reliability for the A, B, C, D, for February is .893. In the same way the reliability for the A, B, C, D for June was determined from the r of its halves to be .951.

2. *Public School 64.* Since the number of cases was large, it was decided to test reliability here by taking a random sampling from each class of approximately 10 per cent. Accordingly, 10 per cent of the scores for each of 55 classes was taken by

beginning with the first name on the class register and proceeding in alphabetical order until the desired number of cases was obtained. The 195 cases so selected were in round numbers distributed thus:

TABLE IX
RELIABILITY OF OPPOSITES—SCHEME OF SAMPLING FOR 195 CASES
PUBLIC SCHOOL 64

Grade	4	5	6	7	8	Anemic	Total
Number of Classes.....	5	12	11	13	12	2	55
Per Cent of Cases.....	9	23	20	25	21	2	100

The A, B scores were then correlated with the C, D. The result is shown in the accompanying Table XII on page 41.

3. All of the available cases were next taken for the Julia Richmond Annex, distributed as follows:

TABLE X
RELIABILITY OF OPPOSITES
AVAILABLE CASES—JULIA RICHMAN ANNEX

Term	1	2	3	4	5	Total
Number	64	5	48	36	10	163

$N = 76$
$$N = 79$$

CORRELATION BETWEEN WYLIE OPPOSITES A, B AND OPPOSITES C, D.
RANDOM SAMPLING OF ALL CLASSES
PUBLIC SCHOOL 64

$N = 195$

	2	3	2	3	6	15	32	37	23	20	27	10	5	4	3	2	1				N
100																					
95																					
90																		1			1
85																	1				1
80																	1				1
75													1								1
70											2	1									3
65									2	1	2	4	2	1	1						13
60									1	6	2	2	1	1							13
55							1	1	1	3	4			2							12
50							1	1	2	6	8	2			1						21
45							3	8	3	4	3	1									22
40						1	3	6	3	3	1										17
35						1	3	10	5	2											21
30				1	1	4	7	4	4		1										22
25					2	2	4	5	1												14
20						1	3														4
11-15				1		4	4		1												10
6-10		1				1	1	1	2	1											7
1-5	1					1	1	2													5
0	1	2	2	1	1																7
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

Score in Opposites C, D.

N = 195

4. *High School of Commerce.* Similarly a number of the 2nd- and 4th-year scores of the High School of Commerce were distributed thus:

CASES FOR HIGH SCHOOL OF COMMERCE

Term	3	4	7	8	Total
Number	33	2	7	34	76

5. *The Thorndike Group.* The r for the Thorndike Group was likewise obtained between A, B and C, D.

6. *English A and English B.* For these two groups the data at hand permitted a variation. The r for A, B with C, D was first obtained as before. Then for each of the two groups the total score for f, l, r, t was correlated against A, B, C, D with the results shown in Table XIV. These last coefficients may be interpreted as indicating the reliability between a 4-element test (that is a test consisting of four lists of words) requiring eight minutes to administer and a similarly built up 4-element test requiring twenty minutes to administer. It should also be noted that when a 4-element test is correlated with another 4-element test, the r is very much larger than when the halves of one of these same 4-element tests are correlated. That is, .858 is a marked advance in reliability over .705; and likewise, .818 over .765. This result is to be expected from common

TABLE XIV
RELIABILITY COEFFICIENTS FOR OPPOSITES FOR ALL GROUPS

Group	Opposites series correlated		N	Pearson r	P. E. of r	Reliability Coefficient obtained from r of halves by "Brown's Formula"
1. Garden City	A, B, C, D Feb.	× A, B, C, D June	76	.812	±.027	- -
Garden City	f, l, r, t March	× f, l, r, t, June	76	.832	±.024	- -
Garden City	A, B, Feb.	× C, D Feb.	76	.808	±.028	.894
Garden City	A, B June	× C, D June	76	.906	±.014	.951
2. Public School 64	A, B	× C, D	195	.817	±.016	.899
3. Julia Richman Annex High School	A, B	× C, D	163	.748	±.024	.856
4. Commerce High School	A, B	× C, D	76	.669	±.044	.802
5. Thorndike Group	A, B	× C, D	49	.792	±.036	.884
6. English A	A, B	× C, D	171	.705	±.026	.827
English A	f, l, r, t	× A, B, C, D	168	.858	±.014	- -
English B	A, B	× C, D	161	.765	±.022	.866
English B	f, l, r, t	× A, B, C, D	161	.818	±.018	- -

sense as well as from theory, but it well illustrates two of the fundamental devices by which it is possible to increase the reliability of a test; namely, to increase the number of elements, or the length of the test.

While evaluating the data of Table XIV it may be worth while to recall the following quotation from Kelley (*Journal of Educational Research*, May, 1921): "To secure a reliability coefficient of 0.40 from a group composed of children in a single grade is probably indicative of greater, not less, reliability than to secure a reliability coefficient of 0.90 from a group composed of children from the second to the twelfth grades inclusive."

See also the discussion on reliability by Wood. (Bibliography Reference 30.)

It may be of interest to compare the reliability coefficients of the Opposites Test as reported in Table XIV with the newer forms of examinations used in the course Contemporary Civilization in Columbia College.²

TABLE XV
RELIABILITY OF COLUMBIA COLLEGE EXAMINATIONS

Test	Time	Reliability Coefficient obtained from r of random halves
Completion.....	30 minutes	.90
Part I, Columbia College Examination.....	60 minutes (approx.)	.90
Whole of Columbia College Examination.....	120 minutes	.95

The reliability coefficients as reported by Dr. A. L. Rogers for her sextet of tests for diagnosing mathematical ability are given in Table XVI. (See Bibliography, Reference 15.)

In Table XVI, r_1 means the reliability coefficient or coefficient of correlation for two applications of the test; r_2 means the reliability coefficient for two applications combined. Other recently reported coefficients of correlation with which the Opposites may be compared are given in Table XVII.

² These data are from the Report prepared by Dr. Ben D. Wood on "The Reliability and Difficulty of the College Entrance Examination Board Examinations in Algebra and Geometry." 1921. (See Bibliography, Reference 14.)

The Opposites Test

TABLE XVI

RELIABILITY COEFFICIENTS FOR ROGERS' SEXTET

	r^1	r^2
Algebraic Computation.....	.79	.88
Interpolation.....	.94	.97
Geometry.....	.75	.86
Superposition.....	.82	.90
Mixed Relations.....	.79	.88
Trabue Language Scales L and J.....	.33	.49

TABLE XVII

COEFFICIENTS QUOTED FROM ABBOTT AND TRABUE, BRIGGS, AND WOOD

	Correlation	Subjects	N	r
Abbott and Trabue, Exercises in Judging Poetry. [16]	Series X with Series Y	2-, 3-, and 4-Year High School	127	.440
Abbott and Trabue, Exercises in Judging Poetry. [16]	Series X with Series Y	2-, 3-, and 4-Year College	273	.656
Abbott and Trabue, Exercises in Judging Poetry. [16]	Series X with Series Y	Graduate Students in English	249	.723
Briggs, English Form Test. [17]	Alpha with Beta	Seventh and Eighth Grade	100	.761
Briggs, English Form Test. [17]	Alpha with Alpha Repeated	Seventh and Eighth Grade	100	.729
"Case method' examinations of three hours' duration." Reported by Wood [18, p. 23].	Self-correlation	Columbia University Law School, Final Examinations, 1923.	....	"about 0.70"
"New Type parts of final examinations." Reported by Wood [18, p. 29].	Self-correlation	Columbia University Law School, Final Examinations, 1923.	200	0.66 (average)

An examination and comparison of the coefficients of correlation and reliability for the Alphabetical Opposites with those of representative tests, both of general and specific ability, warrants the statement that the Opposites maintain a high degree of reliability for all groups from the 4th grade of the elementary school through college.

The reliability coefficient of A, B, C, D for grades 4 to 8 ranges from .89 to .95; for the high school groups, from .80 to .86; and for college classes, from .83 to .88.

CHAPTER IV

THE SIGNIFICANCE OF THE TEST AS A MEASURE OF INTELLIGENCE

Quite apart from any specialized or narrowly restricted capacity or ability which the Opposites Test may measure, it has long been known that it is an unusually sensitive and trustworthy instrument by which to measure "intelligence."

Thus Brigham says in discussing Test 4 of the Army Alpha:

If one will review the experimental literature of intelligence testing, he will find the synonym-antonym or "opposites" test, used sometimes as a test of controlled association, sometimes as a test of vocabulary, sometimes as a test of intelligence, but uniformly with excellent results. Given a group with a knowledge of English and sufficient intelligence to understand the nature of the problem, the synonym-antonym test will give as good a differentiation between the bright and dull members of the group, rated by an outside criterion, as any other standard test now available. [19]

The present writer does not need for the purposes of this study to add another elaborate definition to the many that are already current for the term intelligence. It will simply be stated that by intelligence is here meant that organization or hierarchy of desirable capacities and abilities which can be recognized and correspondingly rewarded by high scores attained in so-called intelligence or mental tests such as the Army Alpha, the Thorndike College Entrance, the Haggerty, Otis, National Research Council, Terman Revision of the Binet-Simon, etc.

This same general combination of capacity plus ability is also commonly measured by success in school subjects, that is, by school "grades" and "marks." There are of course other ways of deciding upon the degree of a person's intelligence; for example, the opinions of his associates or teachers, or his success in manipulating things, or his success in responding to certain social situations presumed to test his intelligence. However, for the purpose of establishing a criterion by which to assay the Alphabetical Opposites, the scores in various standard tests and school grades were convenient and seemed sufficient.

Having determined upon the combination of test scores or school grades which is to constitute the criterion, we can then evaluate the Opposites by calculating the correspondence or correlation between Opposites scores and criterion scores for the same school population. In other words, we are then determining the *validity* of the Opposites, that is, the "correspondence between the ability measured by the tests and ability as otherwise objectively defined and measured." [13, p. 195] The heading of particular chapter might thus then very properly have been "Validity," and so be complementary to the chapter caption "Reliability."

1. *Garden City*. For the Garden City group there were available, among others, two criteria that were trustworthy and with which the Opposites could be conveniently compared to estimate their validity.

a. The first of these criteria was the MA or mental age, determined by the Stanford Revision and reported as of May 1, 1920. The sums of the February A, B, C, D scores were correlated with these MA's for 82 cases distributed as follows:

TABLE XVIII
MENTAL AGE POPULATION
GARDEN CITY

Grade	4	5	6	7	8	Total
Number	25	20	17	10	10	82

An r of $.755 \pm .032$ was thus obtained. This may fairly be designated as "high."

b. The second criterion was a composite derived from a series of five "quotients" reported as of May 1, 1920; the IQ and an AQ, VQ, RQ, and CQ. These last four quotients were each a number or factor (as 84, 100, 154, etc.) which had been obtained from the results of measuring the pupil's ability by means of the following tests: Woody-McCall, I and II; Thorndike Visual Vocabulary x and y , and Alpha 2; and Kelley-Trabue Completion, Alpha and Beta. These quotients represented, in a manner analogous to the method of the intelligence quotient, the ratings of each pupil in the arithmetic, visual vocabulary, reading, and completion tests. To form a criterion these five Q's were added together, the sum divided by 5, and the result

multiplied by the chronological age expressed in months. This composite was then correlated for all the 65 available cases of the 82. These 65 were distributed as follows among the different grades.

TABLE XIX
QUOTIENT POPULATION

GARDEN CITY						
Grade	4	5	6	7	8	Total
Number	19	18	14	4	10	65

The resulting r was again distinctly high: $.772 \pm .036$. For the distribution of these composite scores see Table XX.

TABLE XX

CORRELATION BETWEEN WYLIE OPPOSITES AND $\left(\frac{IQ + AQ + VQ + RQ + CQ}{5} \right) \times \text{AGE}$
 GARDEN CITY—GRADES 4, 5, 6, 7, 8
 $r = .772 \pm .036$

$N = 65$

Score in Opposites—A, B, C, D for February, 1920

	1	1	6	3	8	6	5	6	4	4	7	3	5	3	1	2	
190															1		1
85																	
80																	
175																	
70																	
65																	
60																	
55											1						1
150														1			1
45														1			1
40																	
35														1	2		3
30																	
125															1		1
15												1	1	1			2
20											1						1
10									1		1						2
5					1						1	2					4
100						1		2			1	1	1		1		7
95					1	2			1	1		2	1				8
90				1			1	1		2							5
85						1		1									2
80		1				1				2							4
75				1			1		2		1						5
70				1	1	1	2	1									6
65				1		1	1										3
60			1														1
55				1													1
50				1													1
45							1										1
40																	
35																	
30																	
25																	
16-20																	
11-15						1											1

$N = 65$

$\left(\frac{IQ + AQ + VQ + RQ + CQ}{5} \right) \times \text{Chronological Age, May 1, 1920}$

(110 means 106 to 110, etc.)

2. *Public School 64.* The population of Public School 64 had been subjected to a great variety of tests during the month preceding and the month following the giving of the Opposites Test and an unusually dependable criterion had been built up from the records of some twenty-seven classes apportioned as follows:

TABLE XXI
CRITERION POPULATION BY CLASSES
PUBLIC SCHOOL 64

Grade	5	6	7	8	Total
Number of Classes.....	3	7	9	8	27

These twenty-seven classes averaged about 40 pupils to the class, thus providing the records of approximately 1000 individuals that could be drawn upon. These classes will be referred to here as the Criterion Group. This criterion score consisted of a single number which represented the combined scores of the subject in six tests, each of which had received equal weight in computing this composite.¹ The six tests composing the criterion were: The National Intelligence Tests, Scale A and Scale B; the Haggerty Intelligence Test, Delta 2; the Otis Intelligence Scale, Advanced; Meyers' Mental Measure; and the Kelley-Trabue Language Test (Completion) Alpha. It should be noted that, as usually given, these six tests require over three hours to administer as compared with the twenty minutes consumed by the A, B, C, D Opposites. This twenty minutes does not include the time necessary to pass out papers, etc.

a. From the Criterion Group were next picked out all those ten-year-olds for whom an A, B, C, D Opposites score was also available and the *r* computed. (By a ten-year-old is meant anyone who is 120 months or more in age but who has not reached 132 months.) The same procedure was followed for the eleven-, twelve-, thirteen-, and fourteen-year-olds with the results of Table XXVII. (See also Tables XXII, XXIII, XXIV, XXV, and XXVI.)

¹ For a brief account of this Criterion see the article, "Unreliability of Individual Scores in Mental Measurements," Dr. J. L. Stenquist, *Journal of Educational Research*, December, 1921, p. 350. (See Bibliography, Reference 20.)

TABLE XXIV

CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION
PUBLIC SCHOOL 64—TWELVE-YEAR-OLDS

$$r = .765 \pm .025$$

	1	1	2	3	5	7	15	11	12	13	18	11	13	7	6	2	1	Σ
160															1	1		2
155									1									1
150													2		1	1		4
145															1			1
140														1				1
135										1				1				2
130														1		2		4
125													2					2
120											1	2	1	1				5
115												1						1
110							1					1	4	2				8
105							1					1	1	2	1			6
100								1	1	2	3	1	1			1		10
95									1	2	2	1	1	1			1	9
90								1	3	2	1			1				8
85							1		1	1	3							6
80							2	2	1	2	1							8
75				1				2	1	2	1	2		1				10
70						1	1	2	1	1	1	1	3	1				11
65							1	2	1	1			2					7
60					1			1	3	1	1							7
55																		0
50				1			1	1										3
45					1	1	1		1									4
40								1										1
35						1												1
30					1			1										2
25		1							1									2
20						1												1
11-15																		0
6-10			1															1
1-5																		

16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

Score in 6-Test Criterion

$N = 128$

The Opposites Test

TABLE XXV

CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION
PUBLIC SCHOOL 64—THIRTEEN-YEAR-OLDS

$$r = .684 \pm .029$$

Score of 13-year-olds in Wylie Opposites—A, B, C, D.

 $N = 149$

	1	4	2	9	11	8	18	24	10	19	15	16	11	1											
160													2												
155													1												
150													1	1											
145													1												
140						1				1			1												
135											1	1													
130													1												
125						1			1		1	1													
120										1	2	2													
115										1	2		3												
110										2	2	1		1											
105									2		4		2	2											
100								1	4		2	3	1	1											
95						1		3	1	2		2	3												
90						1		1	2	5	1	1		1											
85								4	4		4	4	1												
80						1	3	2		3		1	1	1											
75							2	1	2		2														
70						1	1	2		2	2														
65						2	1	1	2		2	2	1	1											
60							1		1	2	2														
55							2		1																
50							1																		
45						1				1															
40																									
35																									
30							1																		
25																									
20						1																			
11-15																									
6-10																									
1-5																									
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	
	Score in 6-Test Criterion																								

Score in 6-Test Criterion

 $N = 149$

TABLE XXVI

CORRELATION BETWEEN WYLIE OPPOSITES AND CRITERION
PUBLIC SCHOOL 64—FOURTEEN-YEAR-OLDS

$$r = .667 \pm .038$$

Scores of 14-year olds in Wylie Opposites—A, B, C, D.

	1	1	0	3	4	10	12	14	13	8	12	9	5	2	2		N = 96
210															1		1
205																	0
200																	0
195																	0
190																	0
185																	0
180																	0
175																	0
170																	0
165																	0
160																	0
155															1		1
150																	0
145														1			1
140																	0
135												1		1			2
130									1					1			2
125																	0
120											1		1				2
115									1		1						2
110											2						2
105							1	1		2	1	2	1				8
100							1	1		1	3		1				7
95								1	1		2						4
90							1	2	6		2	1	1				13
85						1	3	1			2	2					9
80					1	3	1	4	2	1							12
75					1	1	1	3		1							7
70				2		2	1		2								7
65				1	1	1	1		1	1							6
60	1				1				1		1						4
55						1	1	1									3
50																	0
45																	0
40		1				1	1										3
35																	
11-15																	
6-10																	
1-5																	
	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50

Score in 6-Test Criterion
55

N = 96

TABLE XXVII

CORRELATION OF OPPOSITES WITH CRITERION FOR EACH AGE-GROUP

PUBLIC SCHOOL 64

	Age	N.	<i>r</i>	P. E.
Alphabetical Opposites, A, B, C, D × Criterion 10	73		.654	± .046
Alphabetical Opposites, A, B, C, D × Criterion 11	103		.766	± .028
Alphabetical Opposites, A, B, C, D × Criterion 12	128		.765	± .025
Alphabetical Opposites, A, B, C, D × Criterion 13	149		.684	± .029
Alphabetical Opposites, A, B, C, D × Criterion 14	96		.667	± .038

These results are distinctly significant and are in some respects the most important of the entire experiment. They may be summarized briefly thus: (1) The *r* between twenty minutes of Opposites and a criterion consuming about ten times that amount of time ranges from "high" to "very high." (2) The P.E.'s are small. (3) The groups measured are large enough to warrant confidence in the performance of the test with large numbers. (4) The highest correlations are found in the eleven- and twelve-year groups. This is as might be expected since these two ages are probably more nearly a normal sampling in ability of all the eleven- and twelve-year-olds of the whole school population than are the other ages. Thus the duller ten-year-olds are usually found below the fifth grade level and the brighter thirteen-year-olds have passed beyond the eighth grade and into high school or "life."

It is also of value to compare the above correlations with those of Table XXVIII, reported by Dr. Stenquist for the Criterion Group from which these five age-groups were taken. These correlations are:

TABLE XXVIII

CORRELATION OF VARIOUS INTELLIGENCE TESTS WITH CRITERION

PUBLIC SCHOOL 64

	<i>r</i>	N.
National Intelligence Test, Scale A × the Criterion.....	.801	560
National Intelligence Test, Scale B × the Criterion.....	.788	518
Otis Intelligence Scale, Advance × the Criterion.....	.680	551
Haggerty, Delta 2 × the Criterion.....	.808	532
Thorndike Visual Vocabulary × the Criterion.....	.680	461
Kelley-Trabue Language Test × the Criterion.....	.58	581
Woody-McCall Arithmetic × the Criterion.....	.39	298
Meyers' Mental Measure × the Criterion.....	.48	544

If we take the average (unweighted) of the five r 's of Table XXVII we find it to be .707. But this average r by comparison with Table XXVIII is found to be higher than that of five of the eight tests there recorded, and exceeded only by the National Intelligence Tests A and B and the Haggerty Test. Further, the two National Intelligence Tests require thirty to thirty-five minutes each, as compared with the twenty minutes of the Alphabetical Opposites. It is of particular interest that the Alphabetical Opposites should show a higher r with the Criterion than either the Thorndike Visual Vocabulary or the Kelley-Trabue Language Test.

b. The Alphabetical Opposites were next correlated with the Haggerty Delta 2 by the following method. Two hundred and eighty cases were selected from all grades (whether in the Criterion Group or not) for such eleven- and twelve-year-olds as were available. These 280 cases were distributed as follows:

TABLE XXIX

POPULATION FOR HAGGERTY DELTA 2

PUBLIC SCHOOL 64

Grade	5	6	7	8	Total
Eleven-Year-Olds	21	102	15	1	139
Twelve-Year-Olds	10	74	48	9	141
Total	31	176	63	10	280

Eleven- and twelve-year-olds were picked for the reason that these two ages were likely to exhibit a fairly normal distribution of ability if drawn from grades 5, 6, 7, and 8. These two ages would also suffer less from the various constant factors that tend to eliminate younger or older pupils from the field of view of the tests under consideration. Or stated another way: a large proportion of all eleven- and twelve-year-olds in school was likely to be found within the boundaries of grades five to eight and comparatively few above or below these limits.

The Haggerty Delta 2 is divided into six parts. The total scores of each of the 280 pupils for the first half of this test, that is, for parts 1, 2, and 3, were correlated with the A, B, C, D scores. In a similar way the r was obtained for the second half of the Delta 2 with A, B, C, D, that is, for parts 4, 5, and 6. The results are given in Table XXXIV. (See also Tables XXX and XXXI.)

c. Correlations were next made between A, B, C, D and the two National Intelligence Tests. (See Tables XXXII and XXXIII.) All available cases in grades 5, 6, 7, and 8 were taken, the ages not being selected in any way and ranging from 8 to 16 years, but falling mostly within the 9- to 15-year limits. The number of cases, 563 and 496, are not two separate populations, but overlap. The results follow:

TABLE XXXIV
CORRELATIONS OF OPPOSITES WITH HAGGERTY DELTA 2 AND NATIONAL
INTELLIGENCE TEST
PUBLIC SCHOOL 64—GRADES FIVE, SIX, SEVEN AND EIGHT

	Ages	N	<i>r</i>	P. E.
A, B, C, D $\times$ Haggerty Delta 2, first half	11 and 12	280	.649	$\pm .024$
A, B, C, D $\times$ Haggerty Delta 2, second half	11 and 12	280	.675	$\pm .022$
A, B, C, D $\times$ National Intelligence, Scale A	8 to 16	563	.683	$\pm .015$
A, B, C, D $\times$ National Intelligence, Scale B	8 to 16	496	.649	$\pm .017$

These four *r*'s strongly reinforce those obtained for A, B, C, D with the criterion. Their significance may be epitomized thus: The Alphabetical Opposites for grades 5 to 8 show a high correlation with rather complicated group intelligence tests of established validity but which require from 50 to 75 per cent more time to administer. This high *r* holds both for populations restricted in age, as the eleven- and twelve-year-old groups, and for comparatively large and heterogeneous groups as in the eight- to sixteen-year selection.

TABLE XXXV
SCORES FOR PUBLIC SCHOOL 64

Individual Scores for Opposites A, B, C, and D Made by Pupils Tested in Grades 4 to 8—Fifty-three Classes and about 1900 Cases.

[This Table has been omitted for the reason that, although so many of the conclusions of the experiment rest on the findings for Public School 64, to print the complete scores would require some fifty pages. A typewritten copy of these has been filed at Teachers College. The scores for the same classes in the various intelligence tests referred to in the text are on file in the office of the Bureau of Reference and Research, Board of Education Building, Fifty-ninth Street and Park Avenue, New York City.]

3. *High School of Commerce.* In order to compare scores obtained in Alphabetical Opposites with high school grades and

TABLE XXX

CORRELATION BETWEEN WYLIE OPPOSITES AND HAGGERTY DELTA 2 (FIRST HALF)
PUBLIC SCHOOL 64—ELEVEN- AND TWELVE-YEAR-OLDS

$$r = .649 \pm .024$$

Score in Wylie Opposites—A, B, C, D.

$N = 280$

	1	1	2	3	4	4	3	12	10	6	13	22	12	25	19	18	22	17	15	16	16	15	9	5	5	2	1	2	
185																											1		1
180																													
175																													
170																													
165																				1									1
160																									1			1	2
155																													
150																													
145																								1					1
140																					1							1	2
135																					1								1
130																							1						1
125																									1				1
120												1											1	1			1		4
115																1				1	1	1	1						5
110														1				2	1		2		2						8
105													1	1					2		2	1	1	2	2				12
100												1					1	1	3	2		1	6	2					17
95								1							2	2		1		2	1	2	2		1	1			15
90														1	1		6	1	1	4	1	1							16
85								1		1					2	4	4	3	1	1	2	1	1				1		22
80			1	1				1		1	2	3	2	4	1	2		2	1	3	1	1	1						27
75								1	1	1	5	2	6	4	1	3	3	2	2	1				1					33
70								2	1			5	1	1	1	2	2	3		1		1	1						21
65								1	1	3	3	1	3	2	2	2			1		3								22
60				1	1		1	2	1		2	1	1	1	1	3	2	1											18
55		1			1	1	1	2	2			3		2		1													14
50								2	1				1	1	1		1												7
45						1		1		1	1	2	1		1				1										9
40			1				1	2			2		1																7
35	1				1													1											3
30				1	1					1			1		1														5
25						1															1								2
20																1													1
11-15									1																				1
6-10						1																							1
1-5																													
0																													

12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 $N = 280$

Score in Haggerty Delta—2, 1st Half

(12 means 11 and 12, etc.)

CORRELATION BETWEEN WYLIE OPPOSITES AND HAGGERTY DELTA 2 (SECOND HALF)
PUBLIC SCHOOL 64—ELEVEN- AND TWELVE-YEAR-OLDS

280 = N

[illegible]

TABLE XXXII

CORRELATION BETWEEN WYLIE OPPOSITES AND NATIONAL INTELLIGENCE TESTS (SCALE A)
PUBLIC SCHOOL 64

$$r = .683 \pm .015$$

Score in Wylie Opposites--A, B, C, D.

563 = N

	2	4	4	5	22	16	17	34	32	25	30	46	36	35	39	42	45	32	31	21	15	12	9	5	3	0	1		
210																													1
205																													0
200																													0
195																													0
190																													0
185																													1
180																													0
175																													0
170																													0
165																													0
160																													4
155																													3
150																													7
145																													3
140																													4
135																													9
130																													8
125																													10
120																													15
115																													11
110																													25
105																													26
100																													35
95																													32
90																													44
85																													49
80																													53
75																													48
70																													50
65																													47
60																													27
55																													12
50																													8
45																													13
40																													6
35																													2
30																													3
25																													3
20																													1
11-15																													1
6-10																													1
1-5																													1

50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	

563 = N

Score in National Intelligence Test, Scale A

TABLE XXXIII

CORRELATION BETWEEN WYLIE OPPOSITES AND NATIONAL INTELLIGENCE TESTS (SCALE B)
PUBLIC SCHOOL 64

$$r = .649 \pm .017$$

496 = N

Score in Wylie Opposites—A, B, C, D.

	2	0	1	4	8	8	9	12	26	43	33	47	44	42	35	29	27	41	23	25	16	4	6	3	4	1	0	1	2
195																													
190																													
185																					1								
180																													
175																													
170																													
165																													
160																				1	1		1			1			
155																		1						1					
150														1					3	1	2								
145																			1						1				
140												1							1		1	1							
135													1				1	3	1		1		1						
130																	1	3		2									
125														2			1	1	1	2	2								
120																		4	5	1	2								
115													1				1	2	3	1	1								
110													1	2	2	1	2	4	1	6	2		1		1				
105									1	1			6	5	1	3		2		2			1	1					
100									1		4	4	4	2	1	4	2	3	3	2	1						1	1	
95										1	1	2	2	3	5	4	1	5	1	2					1				
90									1		2	2	8	6	7	2	6	2	1		1		1	1					
85						1	2		1	1	2	3	5	6	4	4	1	3	3	3	1	1							
80							1		4	6	6	3	7	3	4	5	1	3											
75	1						2		1	7	4	5	8	5	5	2	1	3	2	1						1			
70	1							2		1	4	1	7	4	6	5	2	2	5	2	2								1
65					2			1	2	3	4	9	4	5	1	3		1	1	3	1								
60					1		1	1	1	3	4	2	2	2	3		1												
55						1			1	1	2	1	4																
50				1					1		3		1																
45					1	3			1		2	2	1	1				1											
40								1		1		3	1																
35								1					1																
30							1				1			1															
25					1	1			1																				
20						1																							
11-15										1																			
6-10						1																							
1-5												1																	

496 = N

50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190

Score in National Intelligence Test, Scale B

to arrive at some idea of just what capacities or abilities were tested by the Opposites, a transcript was made of the marks of all of the 110 pupils with A, B, C, D scores for the semester ending June, 1920,—the month in which the Opposites Test was given. The school subjects with the number of term grades available for each were as follows:

TABLE XXXVI

TERM GRADES FOR EACH SCHOOL SUBJECT AVAILABLE FOR COMPARISON
WITH OPPOSITES

HIGH SCHOOL OF COMMERCE

English	109	Economics	43	Typewriting	86
Spanish	48	History	58	Drawing	63
Mathematics	48	Bookkeeping	91	Arithmetic	37
Science	23	Writ. Stenography.	24		

In the case of the English grades a series of four marks was tabulated: the class grade at the end of 5 weeks; at the end of 11 weeks one grade on class work and a second based on a written examination; the final grade for the whole semester.

By way of comment upon the various school subjects here listed and the abilities which they represent, either separately or combined in a criterion, it may be stated that they naturally have in most cases a distinctly vocational character. Generally speaking, the science is largely applied science; the history includes commercial history; bookkeeping in the higher grades exercises many of the capacities of the usual course in mathematics; drawing includes commercial design as well as the customary practice in line and color; and arithmetic means a drill in the fundamental operations during half of the fourth year.

A criterion built up from these elements, while it will differ from one composed of "purer" or more "academic" subjects, need not on that account be rejected as a test of general intellectual merit. In determining upon this criterion of intellectual ability against which to correlate the Opposites, the experimenter was at once faced with a difficulty. Of the eleven school subjects listed above, three were rather distinctly not very academic in character—written stenography, typewriting, and drawing; and a fourth, bookkeeping, was of somewhat doubtful value. That competence

in these four subjects meant intellectual ability of some sort was evident, but just what this sort might be as compared with ability in such subjects as Spanish and mathematics was not very clear. For the purposes of this experiment it would have been more desirable to construct a criterion by combining the scores for each pupil in English, Spanish, mathematics, and history or economics and to call this composite a measure of intelligence rather than to include the less well-defined abilities indicated by success in stenography, typewriting, and drawing. However, this more desirable procedure could not be followed because, of the 110 pupils for whom there were tabulated scores in both English and Opposites, only 24 pupils could be selected who also presented grades in Spanish, mathematics and bookkeeping.

The term grades in these three subjects for each of the 24 pupils were accordingly added together and averaged, and the result thus obtained was assumed to be at least a fairly representative indicator of the intellectual ability of the particular individual. These 24 numbers were then correlated with the A, B, C, D scores with a resulting r of .324 and a P. E. of $\pm .123$.

The small population (24) and the somewhat restricted range of ability represented by the Spanish, mathematics, bookkeeping composite suggested the expedient of using as a criterion of general ability, the unweighted average for each pupil of all his grades for all subjects reported for the term with the exception of music. This arrangement (Table XXXVII) yielded a much larger group, 106, and a much higher r ; namely, $.434 \pm .053$ as compared with .324. While this r of .434 is not extraordinarily high, it compares very favorably with the correlations usually obtained between class-standing and a single intelligence test, and although considerably lower than the similarly obtained r of .502 (described for the Thorndike group in the following section) it yet justifies the belief that in so far as general ability is measured by means of success in the usual high school subjects, the Alphabetical Opposites Test is a good indicator of that success and that general ability.

It may be of some value to note that both in the case of these 106 high school boys and of the Thorndike group, the school subjects making up the criterion were in the main of a distinctly vocational or professional character and that it might be further assumed that both groups had through their vocational interests

TABLE XXXVII

CORRELATION BETWEEN WYLIE OPPOSITES AND TERM GRADES
HIGH SCHOOL OF COMMERCE

$$r = .434 \pm .053$$

Score in Wylie Opposites—A, B, C, D.

	2	1	4	4	6	5	7	5	16	15	14	9	7	4	4	1	2	N
225												1						1
220																		
215																1		1
210													1	1				2
205																		
200																		
195			1					1						2	1			5
190											1							1
185					1				1									2
180								1		2			1		1			5
175						1			2		3	3	1		1			11
170				1						2							1	4
165							1		1	1	1	1					1	6
160			1									1		1				3
155					1	2	1			3	1	1						9
150					1	1			2	2	1		1					8
145			1							1			1		1			4
140							1	2	2	1	2	1		1				10
135		1							1		2							4
130							1	1	2		1	1	1					7
125					1		1		2	1								5
120				2					1									3
115					1							1						2
110							1			1								2
105		1		1				1		1	1							5
100									1									1
95		1					1											2
90					1													1
85																		
80											1							1
75																		
66-70					1													1
61-65																		

N = 106

General average of all final grades for term

already undergone a process of selection, segregating them from the population at large, that would tend to lower any correlation obtained.

4. *The Thorndike Group.* With the data at hand, an attempt was made to answer the following questions:

a. What is the r between the Opposites Test and the combined results of the six-hours' testing?

b. What is the r between the average of the college grades for each person for the two semesters of the year ending June, 1921 and the rating of these persons by means of six hours of testing?

c. What is the r between college grades and the rating by the Opposites and how does this r compare with that of (a) above?

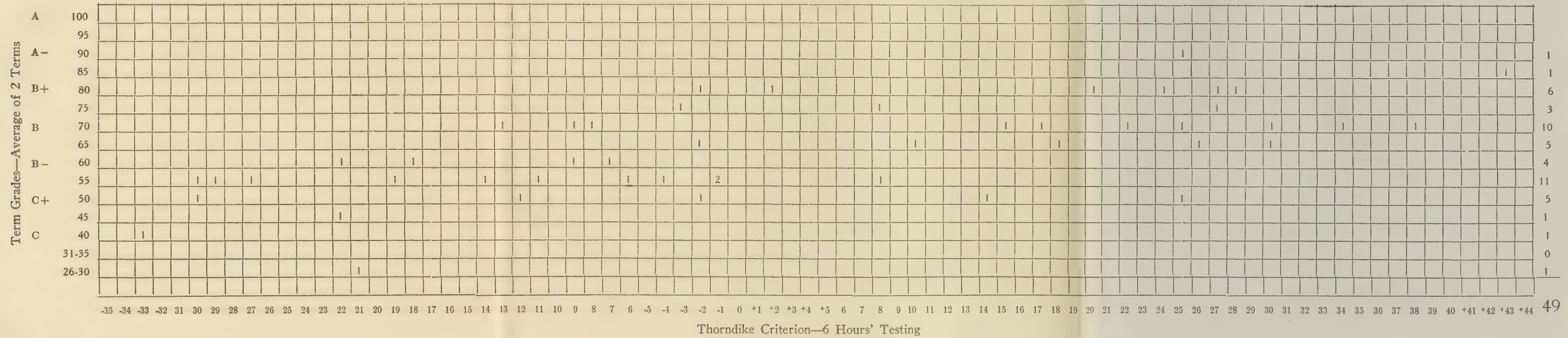
The answers follow:

a. The total scores in Opposites A, B, C, D for the forty-nine individuals were correlated with a series of numbers each of which represented the corresponding relative attainment in the entire six hours' testing. In others words the Opposites were compared with an unusually thorough mental survey which can fairly be accepted as approaching the best possible measure of general intellectual ability that could be obtained of these 49 persons by any six-hour combination of tests and measurements. The resulting r , $.725 \pm .046$, is distinctly high and satisfactory, especially when one takes into account the fact that the twenty minutes of Opposites are being compared with three hundred and sixty minutes of varied and miscellaneous testing.

b. In determining the average of the college grades, all marks for the two semesters (September 1920 to June 1921) were included except those for practical work in physical education. Two persons who had been enrolled for but one semester were given the same average for the year as for the one term and compensation was also made for one person who had received a grade in but one subject during the second semester. The grades as reported to the registrar of Teachers College were indicated by letters and ranged from Failed to A+. In determining averages, each letter-grade was assigned a corresponding number by the writer as follows: A +, 11; A, 10; A —, 9; B +, 8; B, 7; B —, 6; C +, 5; C, 4; C —, 3; D +, and D, 2; D —, 1; F. o.

The number of separate grades reported for each person varied from 1 to 10 or more according to the number of different courses

TABLE XXXVIII
CORRELATION BETWEEN TERM GRADES (AVERAGE OF TWO TERMS) AND THORNDIKE CRITERION
THORNDIKE SIX-HOUR GROUP
 $r = .614 \pm .061$



taken, 5, 6, or 7 being the more usual numbers. Although the various courses were often obviously unequal in the number of points of credit allowed, and very probably were unequal in difficulty, no provision was made for weighting for either variations in points or in difficulty, but a simple average was made of all the grades for each semester and then the separate totals for the two semesters were again averaged to obtain the final index number. It might have been more scientific to have done differently, but it would have been wasteful of time and energy and moreover would have been of rather doubtful value. It would also have been more advantageous to work with forty-nine individuals who had received forty-nine sets of grades in similar or equivalent subjects, each of the forty-nine taking, for instance, trigonometry, English A, and freshman French or some such conveniently arranged academic program; but since such a happy combination was impossible, owing to the heterogeneous character of the major interests and college rating of the group, the best was made of what proved to be not altogether a bad bargain.

The r between the average of these college grades for the two semesters and the six-hour criterion is $.614 \pm .061$, which may be regarded as fairly satisfactory, everything considered. (See Table XXXVIII, insert.)

c. The total scores in Opposites were next correlated with the average of the grades for two semesters. (Table XXXVIII-A, p. 64.) The resulting r , $.502 \pm .0175$, may not at first seem high, but as a matter of fact is very satisfactory. The r between college grades and any *one* form of intelligence test rarely exceeds .40, while the r 's between college grades and the various standard intelligence and entrance tests vary from "in the thirties" for the Thurstone Test to .60 for the Thorndike College Entrance Test and the Brown University Test. Thurstone has stated that the r between scholarship grades and mental test scores for college students rarely exceeds .5; that .4 and .3 are more usual; and that he has never seen an r over .6 [21].

Table XXXIX (p. 65) shows a few of the results with which the Alphabetical Opposites may be compared in this respect.²

²The information for this table has been taken from page 259 of the article by Professor Guy M. Whipple, "Intelligence Tests in Colleges and Universities," in the *Twenty-first Year-Book of the National Society for the Study of Education*, 1922. (See Bibliography, Reference 22.)

TABLE XXXVIII-A

CORRELATION BETWEEN WYLIE OPPOSITES AND TERM GRADES
THORNDIKE SIX-HOUR GROUP

$$r = .502 \pm .0715$$

Score in Wylie Opposites—A, B, C, D.	1 1 1 5 11 3 6 10 3 6 1 1												N = 49
	1	1	1	5	11	3	6	10	3	6	1	1	
320											1		1
315										1			1
310													
305													
300										1			1
295				1				1					2
290				1									1
285													
280													
275								2					
270				1									1
265										1		1	2
260							1						1
255							1			1			2
250									1				1
245					1								1
240							2	2		1			5
235					1			2					3
230													
225													
220					2			1					3
215					1			1					2
210				1	1		1						3
205									2				2
200					1								1
195					1								1
190						1				1			2
185						1							1
180													
175					1								1
170				1		1	1						3
165								1					1
160				1									1
155									1				1
146-150	1				1								2
141-145				1									1
140													
	C-	C	C+	B-	B	B+	A-	A	N = 49				
	26-30	31-35	40 45	50 55	60 65	70 75	80 85	90 95	100				

Term grades—Average of 2 terms

TABLE XXXIX

CORRELATION BETWEEN SCORES IN VARIOUS INTELLIGENCE TESTS AND SUCCESS IN COLLEGE

School	Test	Correlated with	<i>r</i>
Carnegie Institute of Technology . . .	Thurstone	"Academic Success"	"In the Thirties."
Yale	Army Alpha	"Marks"	.38
(Two Groups)	Forms 5 and 6		.42
Chicago	Various Tests	"College Marks"	.43
Dartmouth	Army Alpha	"Scholarship"	.43
Dartmouth	"Completion of Definitions"		.55
Brown	Brown University Test	Marks for Two Terms	.60
Columbia	Thorndike College Entrance Entire Examination	Success in Freshman Year	.60
Columbia	Part I (1 hour)	Success in Freshman Year	.45-48
Columbia	Part II (1 hour)	Success in Freshman Year	.45

Whether this satisfactory relation between success in the Opposites and success in the academic requirements of college would be maintained under varying conditions remains to be seen; and although few psychologists or college deans would be willing to admit or to deny entrance to a prospective freshman on the evidence of only twenty minutes of testing with Alphabetical Opposites, yet the correlations described for the Thorndike Six-Hour Group are high enough to justify the including of a moderately long list of such opposites, and the consequent heavy weighting of results, in any program of testing involving the higher and more complicated mental functions.

SUMMARY

1. *Garden City*. The r between the A, B, C, D Opposites and the M A's is high (.775). Similarly, the r with a composite derived from the I Q and quotients obtained from standard tests for arithmetic, visual vocabulary, reading, and completion is also high (.772) and in harmony with the results from Public School 64.

2. *Public School 64*. These results are probably the most important of the experiment. With a large population and an adequate criterion, the r 's between the Opposites and the criterion range from .654 to .766. The average of these r 's exceeds those obtained through the use of either the Otis Test, Thorndike Visual Vocabulary, Kelley-Trabue Language, or Meyers' Mental Measure.

Between the Opposites and the National Intelligence Tests, and also between the Opposites and the Haggerty Delta 2, r 's ranging from .649 to .683 were obtained.

3. *High School of Commerce*. The r between the Opposites and a composite of Spanish, mathematics and bookkeeping is .324. The r between the Opposites and a composite of all grades for one term is .434.

4. *Thorndike Group (College)*. The r between the Opposites and a rigorous six-hour intelligence testing was high, .725. The r between the Opposites and an average of term grades for two semesters was .502. This is very satisfactory when compared with the standard tests for college entrance.

CONCLUSION

The Alphabetical Opposites show a very high correlation with general intelligence, in so far as that capacity is measured by the present standard mental or intelligence tests.

CHAPTER V

THE SIGNIFICANCE OF THE TEST AS A MEASURE OF SPECIAL ABILITY

Having discussed in the previous chapter how far the Alphabetical Opposites may be regarded as an index of general intelligence, there will now be considered the problem of how far they may be used as indicators of special ability. Two rather fundamental questions almost immediately suggest themselves.

- I. How do the Opposites compare in performance with those tests designed to measure such functions as the ability to read or the ability to attain success in the Completion Test?
- II. What relation exists between success in the Opposites and success in English, that is, success in a somewhat heterogeneous school subject which requires skill in grammar, reading, composition and appreciation?

I. 1. By way of answer to the first question, the scores of 704 pupils of Public School 64 in the Kelley-Trabue Completion Exercise Alpha were correlated with the A, B, C, D Opposites scores with a result of $.584 \pm .016$. The large number of cases and the wide range of ages, from 8 to 17, mean that considerable confidence may be placed in the result. (See Table XL, insert.) The meaning of the correlation is that to a large degree the Opposites would seem to measure much the same ability as does the Completion Exercise. It is worth recalling that the completion test has always been regarded as probably the best single type of test by which to measure intelligence. It is also interesting that the r reported by Dr. Stenquist (page 56) for the Kelley-Trabue Exercise with the 6-Test Criterion is also .58, almost precisely the same as the Completion r with the Opposites.

2. It is reasonable to suppose that ability in recognizing the printed word and ability in reading are first essentials for any sort of success in the Opposites Test as here given and that a rather high correlation with the Thorndike Visual Vocabulary

CORRELATION BETWEEN WYLIE OPPOSITES AND THORNDIKE VISUAL VOCABULARY

PUBLIC SCHOOL 64

$$r = .645 \pm .018$$

$$N = 494$$

	1	1	1	9	8	20	39	48	51	66	40	58	47	60	26	17	2	N
Score in Wyllie Opposites—A, B, C, D.																		
185																1		1
180																		
175																		
170																		
165																		
160														2		2		4
155														2				2
150												1		4	1	1		7
145												1			1			2
140								1					1	1	1			4
135											1	1	1	3		2		8
130												1		1	3	1		6
125									1				2		2	3		8
120												1	3	6	1	2		13
115												1		4	3	1		9
110				1						2	2	2	3	7	5	1		23
105							1		2	1	2	3	7	6		1		23
100				1		2	1	2	7	3	4	5	5	1	1			32
95							3	4	6	2	4	5	3	1				28
90				1		1	2	3	2	4	9	5	7	4	1			39
85				1	1	1	1	1	2	13	8	5	6	3	1			43
80						3	10	4	10	7	2	3	1	2		1		43
75		1		1	1	2	6	4	7	11	5	5	2	1		1		47
70	1		2		2	2	6	7	8	7	7	2						44
65			1		6	6	8	5	2	1	5	2	3	1				40
60			1		3	1	5	4	2		4	2						22
55				1		3	3	1	1	1								10
50				1		1	3	1		1								7
45			1	1	2	2	2	1	2		1							12
40							2		2		1							5
35				1			1											2
30							2		1					1				4
25						2	1											3
20								1										1
11-15					1													1
6-10								1										1
1-5																		
0																		
	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	

$$N = 494$$

$$N = 704$$
$$N = 704$$

CORRELATION BETWEEN WYLIE OPPOSITES AND WOODY-M'CALL
PUBLIC SCHOOL 64

CORRELATION BETWEEN WYLIE OPPOSITES AND WOODY-M'CALL
PUBLIC SCHOOL 64

$$r = .434 \pm .024$$

$$r = .434 \pm .024$$

[illegible]

496 = N

 $N = 496$

Test is to be expected. (See Table XLI.) This r between the Visual Vocabulary and the Opposites for 494 cases for Public School 64 is $.645 \pm .018$ and may in turn be compared with the r of $.680$ between the Visual Vocabulary and the 6-Test Criterion.

3. It is also reasonable to expect that an r between the Opposites and a test which gauges a function like that measured by the Woody-McCall Mixed Fundamentals (arithmetic) would show a decided drop in amount. Such is the case: 496 scores in the Woody-McCall show an r with the Opposites of only $.434 \pm .025$. (See Table XLII.) This result again harmonizes with the movement of the Criterion r , which with the Woody-McCall drops to $.39$.

The above comments may seem rather obvious, but two points stand out so clearly that they deserve reiteration: (1) The Alphabetical Opposites are peculiarly sensitive for measuring ability involving the functions associated with written language. (2) The r 's of the Opposites with general intelligence seem to synchronize in their upward or downward swing with similar oscillations by such trustworthy instruments as the Completion Test and the Visual Vocabulary.

II. An answer to the second fundamental question of the first paragraph may next be attempted,—how well do the Alphabetical Opposites measure ability in English?

1. *High School of Commerce*. For the purpose of this experiment, and in the absence of other criteria, "ability in English" was assumed to be that competence which is rewarded by satisfactory English grades or marks set down in the school records. These English grades (four in number for each pupil) were described in the preceding chapter.

First, to determine what relation might exist between English ability and general ability, the composite ratings for all four English grades were correlated with the Spanish-mathematics-bookkeeping criterion already described on page 60. For twenty-four pupils the r was $.417 \pm .112$; a result which is not "high," though it indicates a decidedly positive relationship. However, the P. E. is larger than is desirable for conclusive results even though, as compared with its r , it falls very close to the conventional 1:4 ratio which is taken as a safe limit for the proportion between an r and its P. E.

The composite ratings in English for the same twenty-four

pupils were also correlated with their A, B, C, D Opposites scores. The resulting r is .180 with a P. E. of .133. This r is too low to be of any significance. To determine whether this low r was not in part due to the small number of cases considered, another correlation was made of one hundred and seven pairs of scores (including the twenty-four above) with a resulting r of .353 and a P. E. of .058. While this r is approximately twice that of the preceding, it is still not high enough to justify one in saying more than that the correlation between ability in Alphabetical Opposites and ability in English for high school students is present and marked but not high.

2. *English A and English B.* The A, B, C, D scores for English A and for English B were correlated with the final grades in English as reported to the registrar of Teachers College for the semester ending May, 1920, that is, for the semester in which the test had been administered. In scattering the correlation tables, the grades from A to F, inclusive, were divided into twelve classes (A, A —, B +, B, B —, etc.) and the A, B, C, D score was entered by steps of 5. The results were:

TABLE XLIII

CORRELATION OF TERM GRADES IN ENGLISH A AND B (TEACHERS COLLEGE) WITH SCORES IN OPPOSITES

	r	P. E.
English A, Term Grades $\times$ A, B, C, D.....	.289	.048
English B, Term Grades $\times$ A, B, C, D.....	.355	.047

These two r 's, while they indicate a positive correlation between term grades in English for college students and the Opposites, are far lower than had been expected. Two comments are at once suggested: (1) English A and English B, in spite of a wide variation in ability among the members of college classes, may yet represent a highly restricted sampling as compared with the population as a whole, or even with the Criterion Group of Public School 64. Such a restriction of sampling always tends to lower correlations. (2) The words "English ability" are after all a loose and vague category that may actually include many traits some of which are uncorrelated and even antagonistic toward each other. Certainly the phrase has no such definite meaning as would a report of one's achievement in crossing out a 's or t 's from a printed page, or a score of 8.48 in the Thorndike Visual Vo-

cabulary Test. English ability is a term that hospitably gives shelter to a multitude of the minor virtues, such as neatness and punctuality as well as skill in composition, the interpretation of difficult verbal passages, the appreciation of the style and the technique of literature, the ability to speak readily and grammatically, and the not-committing of various blunders of speech that are akin to offenses against good taste and good breeding. However, until some one analyzes out "English ability" in somewhat the same way that Dr. Rogers has differentiated mathematical ability, or as Professor Seashore or Mr. Mohler have examined musical ability, we must be content with the rather vaguely defined phrase "success in English as shown by term grades."

3. *Experts in English.* Since the number of persons examined was so small (10) and since only Tests A and B were administered, the results are suggestive rather than final. (1) The r between A and B scores was $.764 \pm .088$, yielding a reliability coefficient of .866 for the A+B total. (2) The range of the A, B scores was from 115 to 182 with a median of 152. This median score was equalled or surpassed by only two persons of the 174 enrolled in English A (2 scores of 153); 3 persons of the 183 enrolled in English B (scores of 161, 163, and 173); and 4 persons of the 49 in the Thorndike Group (scores of 154, 156, 161, and 174).

The lowest score for the English Expert Group, 115, was equalled or surpassed by 48 persons in English A, 54 in English B, and 23 persons in the Thorndike Group. When in the light of the low correlations just reported for English A and English B, one contemplates these high scores made by expert teachers of English, one might not illogically declare that while the Alphabetical Opposites would be a very good criterion by which to select the instructor of an English class it would be a rather questionable device by which to assemble afterwards a class worthy of his talents!

CHAPTER VI

NORMS AND STANDARDS

By "norms" is meant the record of actual performances and by "standards" (or here, more accurately, "author's standards") is meant a series of scores derived from norms and set up as a goal for future attainment. Scores may be reported in various ways: that is, we may state that the median score for grade 6 is 50; or that the median score for age 12 is 55; or that the median score for a twelve-year-old in grade 6 is 60. Even more exact or complicated methods for reporting a score may be used, such, for example, as stating how far a person's performance is above or below the central tendency for some specified group. In still another way a score may be measured, as in Dr. McCall's T-score by a unit which is "the S.D.-divided-by-ten of twelve-year-old children."¹ Several of the above methods will be made use of as the data warrant.

Public School 64. Table LI, "Scores by Grades," shows the distribution of scores without any regard for age, for grades 4, 5, 6, 7, 8, and includes all cases for which an A, B, C, D score was recorded. An inspection of the table indicates, however, that the grades are not represented in normal proportion, that is, there are too few cases for grades 4, 5, and 6 as compared with grades 7 and 8. To correct this as far as possible, Table LII showing the "Distribution of Population (adjusted)," was next constructed. This adjustment was made as follows: The total actual school population as reported and published for the Borough of Manhattan was taken for the term ending January, 1921, and the proportionate number in grades 4, 5, 6, 7, and 8 was determined

¹ For an account of the T scale see the article by Dr. W. A. McCall: "A Uniform Method of Scale Construction," *Teachers College Record*, January, 1921, pp. 31-51. See also, by the same author, *How to Measure in Education*, Chap. X. (See Bibliography, Reference 23.)

from these data. A factor was next computed for each grade of the Public School 64 distribution of Opposites scores such that when the number of pupils reported for any given grade as having scores in the Opposites was multiplied by the appropriate factor, the result would be a population for that grade "adjusted" so as to be proportioned in the same way as the entire actual enrollment for Manhattan. The factors thus computed for the several grades were:

TABLE XLIV

FACTORS USED IN ADJUSTING THE POPULATION OF PUBLIC SCHOOL 64 TO
CONFORM TO THE PROPORTIONS OF THE SCHOOL ENROLLMENT
FOR THE BOROUGH OF MANHATTAN

Grade	4	5	6	7	8
Factor	3.40	1.60	1.37	1.02	1.00

To make clear this method of adjusting scores, the following very small portion of a large distribution chart is added. (The complete table is omitted for lack of space.)

TABLE XLV

METHODS OF ADJUSTING THE OPPOSITES SCORES FOR PUBLIC SCHOOL 64

SCORES IN A, B, C, D									
Age	Grade	50		55		60		65	
12-0 to	4	1	*3.4	1	*3.4				
	5	2	*3.2	2	*3.2	.....	.....	2	*3.2
12-3	6	1	*1.4	1	*1.4	3	*4.1	3	*4.1
	7	.....	.....	.....	.....	.....	.....	1	*1.0
	8	.....	.....	.....	.....	1	*1.0		
	Totals...	.....	*8.0	.....	*8.0	.....	*5.1	.....	*8.3

The *actual* number of scores is placed directly under the figure indicating the amount of the score for A, B, C, D (as 50, 55, 60, etc.) and just to the right is placed the "adjusted" number of scores marked with a star *. With the exception of the 38 Anemics mentioned below, the A, B, C, D scores for each of the five grades were tabulated by three-month age-periods and adjusted in this way.

The result of this adjustment for the 1792 scores is shown in Table LII. In this and Table LIII, the age "8-0" means from 96 months up to, but not including, 99 months; "8-3" means 99 months up to, but not including, 102 months, etc. A slight discrepancy was introduced into Table LII by the omission from it of 38 Anemics (organized into two special classes) who had been previously included in computing the original factors. However, the total weight of the 38 distributed among the other 1754 cases is relatively slight. The writer is aware of the absurdity of reporting the population to the first decimal, but retained the fraction purposely in order to check results and to indicate the method.

Table LIII is complementary to the table just discussed and indicates the median scores for A, B, C, D for each grade by 3-month intervals. This is a distinctly more elaborate arrangement than the earlier methods of reporting educational or psychological scores, which for the most part have merely stated the median score for each grade, or more recently, for each whole year. However, either one of these methods by itself is hardly sufficient for current educational needs. With the very great use which is being made of tests for purposes of regrading and reclassifying, it is important that we know not only what a 12-year-old can do, but also how he compares with other 12-year-olds who are perched all the way up and down on various rungs of the educational ladder, and who will best maintain their scholastic equilibrium by a happy balancing of their own ability with the skillful diagnosis and grade placement of the school psychologist and the coöperating administrator.

TABLE XLVI
REDUCED TABULATION FROM DATA OF TABLE LIII
(TOTAL POPULATION, ADJUSTED FOR PUBLIC SCHOOL 64)
MEDIAN SCORE FOR OPPOSITES FOR BOTH AGE AND GRADE

Grade	Age in Years						
	9	10	11	12	13	14	15
4.....	57	50	50	54			
5.....	70	63	56	53	51		
6.....		82	72	67	63	68	47
7.....		99	91	88	82	77	77
8.....			146	113	101	96	88

In addition to the median scores by grades, the table also shows the median scores for each age for the five grades combined, Q_1 and Q_3 are also shown, and as a measure of variability, the Q (or by its somewhat unwieldy name, the semi-interquartile range).

The following reduction from this large table (Table LIII) will make certain facts stand out rather clearly. In this reduced tabulation the four median scores for each year have been roughly averaged and set down as whole numbers.

An inspection of the two tables suggests that in general:

1. When the age is kept constant the score rises with the grade.
2. When the grade is kept constant the score falls as the age rises.
3. The gross variability (here the Q) rises steadily from 9 years to 12 and then becomes irregular.
4. There is a considerable fluctuation in the score within any given year when one 3-month period is compared with another. This would probably smooth out if a very large number of scores could be obtained.

Points 1 and 2 above are even more clearly emphasized when a reduced tabulation (Table XLVII) is also presented for the Des Moines data of Table LIV.

TABLE XLVII
REDUCED TABLE FROM TABLE LIV—DES MOINES
SHOWING AVERAGE SCORE FOR OPPOSITES FOR BOTH AGE AND GRADE
BASED ON 7719 CASES

Grade	Age in Years				
	10	11	12	13	14
4.....	36	30	27	29	16
5.....	63	56	49	42	35
6.....	89	81	74	65	62
7.....	102	103	96	86	80
8.....	...	110	121	113	104
9.....	...	...	...	127	126
10.....	...	...	...	145	148
11.....	...	...	...	...	163

TABLE XLVIII

SCORES IN WYLIE OPPOSITES DES MOINES.

Score—A, B, C

Age in Years *

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0		2	51	192	151	107	82	36	25	15	2	1	1							
1-4			26	73	83	77	56	35	17	9	2	1								
5-9		1	17	75	62	81	46	37	22	12	1	1	1							
10-14			8	27	34	26	25	26	10	7	5	1								
15-19			8	51	51	42	36	22	18	7	5	1								
20-24			14	71	49	48	32	35	21	5	5	2			1					
25-29		1	15	43	46	66	45	38	16	11	6	1								
30-34		1	13	81	58	85	62	46	25	15	6	4								
35-39			15	62	70	74	70	54	47	23	6	2	1	2						
40-44		1	13	52	65	78	83	59	41	29	13	2	2	1						
45-49			22	79	99	98	92	92	59	37	13	4	3	1	1					
50-54			20	61	78	137	146	98	78	49	16	10	6	5	1					
55-59			10	42	86	125	140	126	74	67	22	6	5	1	1					
60-64		1	3	28	73	137	146	113	74	74	37	22	8	1						
65-69			5	20	65	106	134	134	108	77	37	16	4	1	1					
70-74			3	8	46	81	116	129	115	77	51	23	7	6						
75-79				8	28	51	99	125	113	72	62	28	15	2	3					
80-84	1			2	11	39	76	103	110	85	52	32	7	4	3	2				
85-89			1	2	12	34	63	66	80	90	59	30	20	2						
90-94					5	19	36	72	81	90	65	33	13	4	2					1
95-99			1	2	2	17	21	47	71	65	34	43	18	5						
100-104				1		8	19	27	50	69	53	41	21	6		1			1	
105-109				1	1	2	16	24	55	50	57	40	11	1						
110-114					2	4	17	25	42	50	52	40	16	3	4	5				
115-119						7	9	15	31	41	51	43	21	5	1	1				
120-124						1	7	9	31	36	40	25	9	1	2					
125-129							5	8	23	27	34	31	9	2	1	1				
130-134							1	3	11	25	30	21	10	5	1	1				
135-139							2	4	9	22	28	21	9	2						
140-144							1	4	9	12	21	21	8	2	2	1				
145-149								1	6	10	21	16	8	1	1					
150-154									4	7	10	10	5	2						
155-159									1	6	8	8	7	3		1				
160-164									3	1	2	10	3	1	1					
165-169										1	5	1	3							
170-174					1					1	2	2		4						
175-179										2	1	3	1							
180-184											3	2		1						
185-189											1									
190-194												1								
195-199										1	2									
200-204											1									
205-209																				
210-214													1							

1 7 245 981 1178 1550 1683 1613 1480 1277 926 600 252 74 26 14 0 0 1 1 N=11,909

* "7 Years" Means 7 to 8 With the Mid-point at 7 Yrs. 6 mos.

Des Moines. The Des Moines data reinforce that for Public School 64 by presenting almost 12,000 cases with which to compare the New York City scores.² The large Table XLVIII shows the distribution for all the tests given. Since series D was not given, the A, B, C cannot be directly compared with the A, B, C, D scores of Public School 64 without the use of some form of compensation for the absence of D similar to that described below for the table showing grade scores when age is kept constant. An inspection of Table XLVIII shows a large proportion of zero scores, a condition not in harmony with the experience elsewhere. These zero scores are not readily equated when the attempt is made to convert A, B, C scores into equivalent A, B, C, D scores.

However, Table LIV for Des Moines makes possible a more direct comparison of these scores with the ones for New York City for ages 10, 11, 12, 13, and 14. The column headed A, B, C is the arithmetic average as reported to the writer. This column when multiplied by the factor under K gives the equivalent A, B, C, D score. The factor K was determined empirically for each whole grade by averaging a number of actual cases from other data than Des Moines in which scores in A, B, C, and D were known and could be readily compared with one another.

It should also be noted that the scores for Des Moines are given as arithmetic averages while those for the rest of the study are given as medians. Since, however, the total number of Des Moines scores is large and since the distribution of Table XLVIII indicates an approach to a normal distribution, it is fair to assume that the difference between the medians and the arithmetic averages for Des Moines will not be great and that consequently the Des Moines averages and the New York medians may be directly compared, at least for rough, inspectional purposes.

Julia Richman Annex and High School of Commerce. (See Tables LV and LVI.) Since the high school group is not large, the two schools are presented together. The first distribution shows the scores for the four years by combining the two distributions in the manner described at the bottom of Table LV. The second distribution, Table LVI, while showing a general increase in median scores from age 13 to age 18, has several marked

² For these data the writer is indebted to Dr. Raymond Franzen, formerly Director of Research for Des Moines.

irregularities in specific portions of the scores. Thus the 15-year olds are lower than the 14-year group; and the 17-year group ranks below the 16-year-olds' scores. A comparison of the two schools, age by age, is given in Table XLIX:

TABLE XLIX
MEDIAN SCORES BY AGE FOR THE HIGH SCHOOL GROUP

	Age in Years							
	12	13	14	15	16	17	18	19
Julia Richman Annex								
Number =	2	14	40	47	38	11		
Median	102.5	130.0	148.8	138.8	147.5	122.5		
High School of Commerce								
Number =		3	13	27	28	17	16	4
Median		137.5	136.3	132.5	154.0	148.8	155.0	130.0

English A and English B. (See Tables LVII and LVIII.) The scores are here distributed into four groups according to the college year. From Table LVII, it will be seen that (1) there is a very wide gap in ability between the seniors in high school and the college freshmen; (2) freshmen and sophomores in college are almost on a level; (3) the college seniors show a very sharp upward trend in comparison with the three classes below.

Points 2 and 3 suggest that students of the first two years of college are a somewhat homogeneous group, but that those of the last year are a much more sharply differentiated selection that are beginning to show the effects of various forces,—scholastic, economic, and social, which, acting with accelerated speed, tend toward eliminating the less able.

The Thorndike Group. This group presents no outstanding peculiarity. Both their median score and the gross variability (*Q*) place them between the college junior and senior groups. (See Table LIX.)

Author's Standards. The following provisional standards based on the norm data for this chapter are suggested for A, B, C, D.

TABLE I

PROVISIONAL STANDARDS FOR OPPOSITES, A, B, C, D

1. GRADES 4 TO 8. Standards by Grades Only.

	Grades				
	4	5	6	7	8
Median Score	48	59	66	80	92

2. GRADES 4 TO 8. Standards by Age and Grade Combined.

Grade	Age						
	9	10	11	12	13	14	15
4.....	50	44	40	35	28	20	.....
5.....	70	63	56	51	46	40	.....
6.....	.....	85	77	70	64	60	55
7.....	.....	100	97	92	84	79	74
8.....	.....	.....	130	117	107	98	90

3. HIGH SCHOOL. Standards by Grade Only.

	Year			
	I	II	III	IV
Median.....	130	140	152	165

HIGH SCHOOL. Standards by Age Only

	Age						
	12	13	14	15	16	17	18
Median.....	120	130	138	144	150	155	158

4. COLLEGE. Standards by Years Only.

	Year			
	I	II	III	IV
Median.....	195	195	205	240

5. SUPERIOR ADULTS WITH SPECIAL TRAINING IN ENGLISH (based on English Expert Group).

A median score of 290 is suggested.

The Opposites Test

TABLE LI
 SCORES BY GRADES FOR A, B, C, D—1792 CASES
 PUBLIC SCHOOL 64

Score	Grades				
	4	5	6	7	8
210					1
5					
200					
95					1
90					
85					1
80					
75					1
70					
65					1
60					1
55			1	2	3
150				2	9
45				2	4
40				7	8
35			1	8	8
30				5	9
25			1	7	11
20			4	11	25
15			6	18	23
10		1	4	29	30
5		1	10	17	35
100		4	15	31	44
95	1	4	20	27	38
90		5	19	53	28
85	1	13	28	55	34
80	3	38	37	39	24
75	11	35	44	35	15
70	22	47	52	40	15
65	21	44	36	24	10
60	19	29	28	19	7
55	23	30	22	7	2
50	17	22	16	5	1
45	21	15	21	8	5
40	18	24	8	4	
35	3	6	4		2
30	2	12	5	2	
25	3	8	5		
20		4	1	2	
15	2		2	1	
10	4	4	3		
5	2	4	2	2	
0	3	8	2		
Total	176	358	397	462	399
(Med.) Q ₁	41.7	46.0	56.2	70.2	80.3
Q ₂	52.8	61.5	69.2	83.9	97.1
Q ₃	63.6	76.6	81.7	98.8	110.2
Q	11.0	15.3	12.8	14.3	15.0

TABLE LII

DISTRIBUTION OF POPULATION (ADJUSTED)

GRADES 4 TO 8 BY THREE-MONTHS INTERVALS—PUBLIC SCHOOL 64

Grade	Age					Age				
	8-0	8-3	8-6	8-9	Total	9-0	9-3	9-6	9-9	Total
4.....			6.8	27.2	34.0	40.8	61.2	95.2	74.8	272.0
5.....			6.4	3.2	9.6	8.0	14.4	24.0	27.2	73.6
6.....									1.4	1.4
7.....						1.0				1.0
8.....										
All Grades.....			13.2	30.4	43.6	49.8	75.6	119.2	103.4	348.0

Grade	10-0	10-3	10-6	10-9	Total	11-0	11-3	11-6	11-9	Total
4.....	102.0	68.0	23.8	17.0	210.8	23.8	17.0	3.4	13.6	57.8
5.....	38.4	59.2	78.4	76.8	252.8	54.4	28.8	27.2	25.6	136.0
6.....	4.2	8.3	11.0	17.9	41.4	26.2	49.3	53.7	49.4	178.6
7.....	4.0	2.0	6.0	8.1	20.1	3.0	10.0	18.1	11.1	42.2
8.....							1.0	1.0	3.0	5.0
All Grades.....	148.6	137.5	119.2	119.8	525.1	107.4	106.1	103.4	102.7	419.6

Grade	12-0	12-3	12-6	12-9	Total	13-0	13-3	13-6	13-9	Total
4.....	6.8	6.8	3.4		17.0		3.4			3.4
5.....	24.0	16.0	6.4	8.0	54.4	12.8	12.8	1.6	6.4	33.6
6.....	38.6	39.7	37.0	26.2	141.5	28.9	27.6	12.5	15.2	84.2
7.....	19.1	46.7	30.5	42.8	139.1	46.6	31.8	26.4	30.4	135.2
8.....	6.0	7.0	21.0	18.0	52.0	25.0	33.0	38.0	43.0	139.0
All Grades.....	94.5	116.2	98.3	95.0	404.0	113.3	108.6	78.5	95.0	395.4

Grade	14-0	14-3	14-6	14-9	Total	15-0	15-3	15-6	15-9	Total
4.....										
5.....		3.2			3.2					
6.....	20.6	15.3	12.5	8.3	56.7	5.6	2.8	4.2	4.1	16.7
7.....	21.4	24.5	20.3	18.3	84.5	9.0	6.0	4.0	5.0	24.0
8.....	37.0	28.0	23.0	26.0	114.0	23.0	21.0	11.0	11.0	66.0
All Grades.....	79.0	71.0	55.8	52.6	258.4	37.6	29.8	19.2	20.1	106.7

TABLE LII—(Cont.)

Grade	Age					Age				
	16-0	16-3	16-6	16-9	Total	17-0	17-3	17-6	17-9	Total
4.....										
5.....										
6.....										
7.....	1.0	3.0			4.0		1.0			1.0
8.....	14.0	5.0	2.0		21.0	2.0				2.0
All Grades.....	15.0	8.0	2.0		25.0	2.0	1.0			3.0

SUMMARY

Age	Number	Grade	Number
8	43.6	4	595.0
9	348.0	5	563.2
10	525.1	6	520.5
11	419.6	7	451.1
12	404.0	8	399.0
13	395.4		
14	258.4		
15	106.7		
16	25.0		
17	3.0		
Grand Total..	2528.8		2528.8

TABLE LIII

MEDIAN SCORES BY AGE AND GRADE (ADJUSTED) FOR A, B, C, D
PUBLIC SCHOOL 64

Grade	Age				Age			
	8-0	8-3	8-6	8-9	9-0	9-3	9-6	9-9
4			47.5	52.5	60.0	62.5	51.7	55.0
5			60.0	75.0	63.8	75.5	68.8	72.5
6								72.5
7					147.5	.....	.....	.....
8								
All Grades								
Q ₁			44.9	45.6	50.5	50.4	40.4	46.2
(Med.) Q ₂			52.4	57.4	61.1	64.1	53.0	59.7
Q ₃			59.7	71.4	66.4	69.3	65.8	71.3
Q			7.4	12.9	8.0	9.4	12.7	12.6

	10-0	10-3	10-6	10-9	11-0	11-3	11-6	11-9
4	50.0	55.0	52.5	42.5	42.5	52.5	57.5	47.5
5	66.3	64.4	58.8	60.6	61.3	60.0	54.4	50.0
6	67.5	80.2	87.6	78.8	75.5	71.7	69.2	70.0
7	90.0	112.5	85.0	106.7	102.5	107.5	86.7	87.5
8	.....	.....	.....	.....	.....	182.5	117.5	137.5
All Grades	.....	.....	.....	.....	.....	.....	.....	.....
Q ₁	42.6	47.8	45.5	45.3	45.3	54.7	56.4	48.8
(Med.) Q ₂	57.0	59.7	60.8	61.3	60.9	68.0	68.8	65.5
Q ₃	65.2	68.8	75.3	70.4	73.9	84.5	80.3	80.8
Q	11.3	10.5	14.9	12.6	14.3	14.9	12.0	16.0

	12-0	12-3	12-6	12-9	13-0	13-3	13-6	13-9
4	50.0	55.0	57.5	.....	.....	42.5	.....	.....
5	51.3	55.0	55.0	50.0	55.0	50.0	32.5	47.5
6	67.0	73.6	72.5	56.8	61.9	68.0	63.8	57.5
7	88.9	87.4	92.6	84.3	82.8	86.7	84.2	76.2
8	120.0	112.5	112.5	106.7	103.8	105.6	97.0	95.8
All Grades	.....	.....	.....	.....	.....	.....	.....	.....
Q ₁	51.3	57.3	66.0	59.5	63.0	63.2	69.7	64.3
(Med.) Q ₂	67.6	76.1	79.9	80.7	78.9	82.3	86.2	79.3
Q ₃	83.7	95.0	99.0	94.8	96.8	99.6	100.5	101.3
Q	16.2	18.9	16.5	17.7	16.9	18.2	15.4	18.5

TABLE LIII (Cont.)

MEDIAN SCORES BY AGE AND GRADE (ADJUSTED) FOR A, B, C, D
PUBLIC SCHOOL 64

Grade	Age				Age			
	14-0	14-3	14-6	14-9	15-0	15-3	15-6	15-9
4								
5		55.0						
6	73.7	67.3	65.8	66.6	25.0	60.0	67.5	43.8
7	79.4	75.0	70.0	81.7	72.5	72.5	77.5	86.3
8	97.9	95.0	95.8	96.3	87.5	84.5	87.5	93.8
All Grades								
Q ₁	70.5	64.6	65.7	70.1	49.0	71.0	66.4	60.7
(Med.) Q ₂	82.2	80.4	77.5	84.6	78.7	81.8	81.2	79.9
Q ₃	97.3	96.7	96.7	98.0	91.6	103.8	90.5	99.9
Q	13.4	16.1	15.5	14.0	21.3	16.4	17.1	19.6
	16-0	16-3	16-6	16-9	17-0	17-3	17-6	17-9
4								
5								
6								
7	67.5	82.5				47.5		
8	87.0	83.8	100.0		67.5			
All Grades								
Q ₁	69.4	75.0						
(Med.) Q ₂	91.5	83.3	100.0		67.5	47.5		
Q ₃	95.3	98.8						
Q	13.0	11.9						

TABLE LIV

AVERAGE SCORE BY GRADES FOR AGES 10, 11, 12, 13, AND 14

DES MOINES, IOWA

Age: 10 Years					Age: 11 Years				
Grade	N	ABC	K	ABCD	Grade	N	ABC	K	ABCD
4-B	292	19.25	1.52	29.3	4-B	92	17.09	1.52	26.0
4-A	305	27.85	1.52	42.4	4-A	124	22.43	1.52	34.0
5-B	450	38.73	1.50	58.1	5-B	265	33.77	1.50	50.7
5-A	217	48.88	1.50	73.4	5-A	241	40.65	1.50	61.1
6-B	139	59.73	1.46	87.2	6-B	387	51.72	1.46	75.5
6-A	43	64.63	1.46	94.3	6-A	206	62.55	1.46	91.4
7-B	13	69.85	1.43	100.0	7-B	121	69.83	1.43	99.8
7-A	3	75.00	1.43	107.3	7-A	35	81.03	1.43	115.8
8-B	0				8-B	8	74.50	1.45	108.0
8-A	0				8-A	2	81.00	1.45	117.5
9-B	1	61.00	1.42	86.6	9-B	1	89.00	1.42	126.4
Total.. 1,463					Total.. 1,482				
Average all grades..... 54.9					Average all grades..... 67.6				
Average 4B-8A..... 54.8					Average 4B-8A..... 67.6				

Age: 12 Years					Age: 13 Years				
Grade	N	ABC	K	ABCD	Grade	N	ABC	K	ABCD
4-B	36	7.56	1.52	11.6	4-B	8	11.75	1.52	17.9
4-A	81	20.27	1.52	30.9	4-A	26	21.19	1.52	32.2
5-B	122	28.40	1.50	42.6	5-B	47	22.13	1.50	33.2
5-A	139	36.18	1.50	54.3	5-A	57	33.89	1.50	50.9
6-B	236	44.68	1.46	65.3	6-B	126	39.97	1.46	58.4
6-A	259	56.77	1.46	82.9	6-A	162	49.20	1.46	71.8
7-B	412	62.57	1.43	89.5	7-B	248	58.49	1.43	83.7
7-A	190	74.67	1.43	106.8	7-A	214	61.55	1.43	88.1
8-B	140	81.64	1.45	118.3	8-B	363	74.20	1.45	107.6
8-A	39	89.39	1.45	129.6	8-A	194	84.06	1.45	121.9
9-B	15	91.53	1.42	129.9	9-B	125	89.42	1.42	126.9
9-A	2	108.50	1.42	154.1	9-A	19	91.63	1.42	130.2
10-B	0				10-B	8	101.87	1.40	142.7
10-A	0				10-A	1	117.00	1.40	163.8
11-B	0								
11-A	0								
12-B	1	117.00	1.37	160.3					
Ungraded	1								
Total.. 1,673					Total.. 1,598				
Average all grades..... 79.9					Average all grades..... 91.5				
Average 4B-8A..... 79.4					Average 4B-8A..... 87.6				

Age: 14 Years									
Grade	N	ABC	K	ABCD	Grade	N	ABC	K	ABCD
4-B	6	4.17	1.52	6.4	9-B	319	85.52	1.42	121.4
4-A	11	14.09	1.52	21.4	9-A	145	95.90	1.42	136.2
5-B	22	18.68	1.50	28.1	10-B	111	105.18	1.40	147.3
5-A	24	27.12	1.50	40.7	10-A	16	107.44	1.40	150.4
6-B	50	37.62	1.46	54.9	11-B	10	118.00	1.37	161.7
6-A	59	46.76	1.46	68.3	11-A	3	121.33	1.37	166.2
7-B	85	53.43	1.43	76.4	12-B	1	140.00	1.37	191.8
7-A	142	56.94	1.43	81.4					
8-B	284	66.03	1.45	95.7					
8-A	215	76.71	1.45	111.2					
					Total.. 1,503				
					Average all grades..... 104.7				
					Average 4B-8A..... 86.6				

TABLE LV

COMBINED SCORES OF HIGH SCHOOL OF COMMERCE AND
JULIA RICHMAN ANNEX

Score A, B, C, D	Year of High School			
	I	II	III	IV
235		1		
30				
25	1			1
20	1			
15		1		1
10		2	1	1
5	1	1		
200		3		
95		2		4
90	1	1	1	
85	1	3	2	1
80		2	1	3
75	2	12		6
70	1	5		2
65	4	7	1	4
60	1	4		2
55	6	14		1
150	4	8	1	4
45	2	5		3
40	5	12		1
35	2	6	1	2
30	6	7		2
25	5	8		
20	1	5	1	
15	5	7	1	1
10	4	5		
5	2	6		1
100	3	5		1
95	5	4		
90	1	1		
85	1	2		
80		1		
71- 75				
66- 70		2		
N =	65	142	10	41
(Med.) Q ₁	110.3	117.5	132.5	143.8
Q ₂	129.6	140.0	170.0	163.1
Q ₃	152.3	163.2	183.8	176.3
Q	21.0	22.9	25.7	16.3

In this table the distribution of scores is by grades (first, second, third, and fourth year of high school) regardless of age. The distribution by schools is:

Year I, all girls, Julia Richman Annex

Year II, 77 girls, Julia Richman Annex; and 65 boys, Commerce High School

Year III, all girls, Julia Richman Annex

Year IV, all boys, Commerce High School

TABLE LVI

COMBINED SCORES OF HIGH SCHOOL OF COMMERCE AND
JULIA RICHMAN ANNEX

Score A, B, C, D	Ages by Whole Years							
	12	13	14	15	16	17	18	19
35				1				
30								
225			1			1		
20					1			
15			1		1			
10			2		2			
5			1		1			
200			2	1				
95		1			2	1	1	1
90			1	2				
85			1	2	3		1	
80			1	1	2	1	1	
175			2	4	11	2	1	
70			1	4	1	1	1	
65		1	4	2	4	3	2	
60				4	2		1	
55			6	7	6	1	1	
150			4	5	5	2	1	1
45		2	1	1	3	3		
40		3	5	3	3	4	1	
35		2	2	3	1	1	2	
30		2	1	5	4	1	2	
125			6	3	3	1		
20			1	6			1	
15	1	1	2	4	3	2		1
10		1	2	4	2			
5			2	3	2			1
100		1	1	3	2	2		
95	1	2	2	3	1			
90		1			1			
85				2		1		
80				1				
71- 75								
66- 70			1			1		
N =	2	17	53	74	66	28	16	4
(Med.) Q ₁	.....	106.3	121.9	113.1	128.1	125.0	132.5	107.5
Q ₂	102.5	131.3	145.6	135.0	152.5	141.7	155.0	130.0
Q ₃	.....	139.6	159.7	158.1	173.0	163.3	170.0	170.0
Q	.....	16.7	18.9	22.5	22.5	19.0	18.8	31.3

In this table all the scores for both high schools are distributed by ages regardless of grades. Twelve years means from 144 months up to, but not including, 156 months; 13 years means from 156 months up to, but not including, 168 months, etc.

The Opposites Test

TABLE LVII

SCORES FOR ENGLISH A AND ENGLISH B
TEACHERS COLLEGE

A, B, C, D Score	Freshman	Sophomore	Junior	Senior
315				
310				
5				
300				
95				
90				
85	1			1
80		1		2
75			1	1
70	4		1	2
65	2	1	1	
60	2			1
55	6	3		1
250	3		2	4
45		1		2
40	5	2	4	1
35	4	4	3	
30	5	3		
25	10	1		
20	5	3	1	
15	8	2	1	2
10	2	6	3	
205	9	5	3	3
200	9	1	1	2
95	7	5		1
90	2	2	3	
85	10	2	1	2
80	5	3	3	2
75	5	7	2	1
70	6		1	
65	7	2	1	1
60	6	1	1	
55	2	4		
150	3			
45	1			
40	2		1	
35	2	2		
30	2	3		
25		1	1	
20	2			
15	1			
106-110		1		
N =	138	66	35	29
Q ₁	170.5	166.8	177.9	195.6
(Med.) Q ₂	198.3	195.0	204.2	242.5
Q ₃	223.8	219.2	238.1	253.8
Q	26.7	26.2	30.1	34.1

TABLE LVIII

SUMMARY OF SCORES IN A, B, C, AND D (TAKEN SEPARATELY)
ENGLISH A AND ENGLISH B

Freshman

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
N =	139	138	139	139
Q ₁	47.9	42.3	35.6	44.9
(Med.) Q ₂	54.3	49.1	41.3	52.9
Q ₃	60.9	60.1	47.9	62.4
Q	6.5	8.9	6.2	8.8

Sophomore

N =	65	66	66	66
Q ₁	47.1	41.8	33.8	47.3
(Med.) Q ₂	51.9	49.0	41.5	53.0
Q ₃	59.2	59.4	51.2	63.3
Q	6.1	8.8	8.7	8.0

Junior

N =	35	35	35	35
Q ₁	44.3	42.3	35.3	51.3
(Med.) Q ₂	54.1	52.2	44.3	57.3
Q ₃	59.3	60.4	50.8	60.9
Q	7.5	9.1	7.8	4.8

Senior

N =	29	29	29	29
Q ₁	51.1	51.3	41.1	50.4
(Med.) Q ₂	60.5	58.8	47.3	61.3
Q ₃	67.8	69.4	57.4	69.4
Q	8.4	9.1	8.2	9.5

The Opposites Test

TABLE LIX

SCORES FOR THE THORNDIKE GROUP

A, B, C, D Score		Scores	A	B	C	D
320	1	100				
15	1	95				
10		90	1	3		
5		85		2		2
300	1	80				5
95	2	75	4	4	2	4
90	1	70	5	3	4	11
85		65	13	8	1	8
80		60	8	6	8	8
75	1	55	6	8	9	2
70	1	50	3	4	2	3
65	2	45	6	4	3	6
60	1	40	2	7	11	1
55	2	35	1		2	
250	1	30	1		3	
45	1	21-25			3	
40	5	16-20			2	
35	3					
30		* N =	50	49	50	50
25						
20	3					
15	2	Q ₁	49.2	46.6	36.1	55.3
10	4	(Med.) Q ₂	58.8	56.3	47.5	63.1
5	2	Q ₃	64.0	64.8	56.6	69.3
200	1					
95	1	Q	7.4	9.1	10.3	7.0
90	2					
85	1					
80						
75	2					
70	3					
65	1					
60	1					
55	1					
146-150	2					
141-145	1					
* N =	50					
Q ₁	186.3					
(Med.) Q ₂	216.7					
Q ₃	251.3					
Q	32.5					

* N = 50 is explained by the fact that an additional person was added to the 49 for all scores except B.

CHAPTER VII

STATISTICAL METHODS

Only a very brief note is at this date needed to explain the statistical methods used. So much work has been done and published in the last few years that it can be safely assumed that the interested reader of this study will already be familiar with the commoner statistical formulae. The r here used is the Pearson r and is uncorrected for attenuation. The various r 's were computed from scattergrams by the formula:

$$r = \frac{\frac{\sum x^1 y^1}{N} - C_x C_y}{\sigma_x \sigma_y}$$

Considerable use was made of the very convenient ruled form devised for scattergrams by Professor H. A. Ruger, of Teachers College.

The P. E. of r was determined through the use of Table X, page 404, Rugg's *Statistical Methods Applied to Education*, first edition [24]. Use was also made of the "Abac for Probable Errors of r ," page 19, *Tables for Statisticians and Biometricians*, edited by Karl Pearson, Cambridge, 1914 [25]; the similar device published by Dr. H. A. Toops, 1921; and the customary formula:

$$\text{P.E.} = .6745 \frac{1 - r^2}{\sqrt{N}}$$

The use of Spearman's formula¹ for determining the coefficient of reliability of a test has already been discussed in Chapter III. If the reader desires a further discussion of this, he is referred to the following references in the Bibliography: [13], pp. 395-397; [18], p. 22; [26], p. 77; [27], pp. 101-102; [28], p. 77; and [29], p. 205.

Concerning the test papers themselves from which the statistical report has been made, it may be added that those papers were

¹ This is sometimes referred to as "Brown's Formula."

excluded from the final accounts concerning the validity of which any reasonable doubt was found to exist. Thus causes for rejection included imperfectly printed test sheets, departure from the time allowance for which suitable correction could not be made, failure to follow directions, and certain unfair practices of other sorts. In other words, the attempt was made to keep the fundamental conditions of the experiment as constant as possible.

BIBLIOGRAPHY

(The numbers 1 to 30 in the left margin correspond to the numbers (in brackets) of the citations made throughout the text. The references are in general arranged in the order in which they occur in the text.)

1. AIKINS, H. A., THORNDIKE, E. L., and HUBBELL, ELIZABETH. Correlation Among Perceptive and Associative Processes. *Psychological Review*, 9: 1902, pp. 374-382.
2. WHIPPLE, G. M. *Manual of Mental and Physical Tests*. Part II, p. 80, 1915.
3. KING and GOLD. A Tentative Standardization of Certain Opposites Tests. *Journal of Educational Psychology*, Vol. 7 (1916), pp. 459-492.
4. GREENE, H. A. A Standardization of Certain Opposites Tests. *Journal of Educational Psychology*, Vol. 9 (1918), pp. 559-56.
5. VAN WAGENEN, M. J. Graded Opposites and Analogies Tests. *Journal of Educational Psychology*, Vol. 11, No. 5 (May, 1920), pp. 241-263.
6. MEANS, MARIE H. A Tentative Standardization of a Hard Opposites Tests. *Psychological Monographs*, Vol. 30, No. 134 (1921).
7. FRANZEN, RAYMOND H. Attempts at Test Validation. *Journal of Educational Research*, Vol. 6, No. 2 (Sept., 1922), pp. 145-158 and especially pp. 149-154.
8. ———. Statistical Issues. *Journal of Educational Psychology*, Vol. 15, No. 6 (Sept., 1924), especially pp. 370-371.
9. ———. The Geography of Intelligence. *Journal of Educational Psychology*, Vol. 15, No. 8 (Nov., 1924), especially pp. 501-512.
10. ALLEN, WILLIAM S. *A Study in Latin Prognosis*. Teachers College Contributions to Education, No. 135. 1923.
11. THORNDIKE, E. L. Instruments for Measuring the Disciplinary Values of Studies. *Journal of Educational Research*, Vol. 5, No. 4 (April, 1922), pp. 274, 279 (I. E. R. Test of Selective and Rational Thinking).
12. Mental Discipline in High School Studies. *Journal of Educational Psychology*, Vol. 15, No. 1 (Jan., 1924), pp. 4, 7.
13. MCCALL, WILLIAM A. *How to Measure in Education*. 1922.
14. WOOD, BEN D. *The Reliability and Difficulty of the College Entrance Examination Board Examinations in Algebra and Geometry*. 1921.
15. ROGERS, AGNES L. *Experimental Tests of Mathematical Ability and Their Prognostic Value*. Teachers College Contributions to Education, No. 89, 1918, p. 45.
16. ABBOTT, ALLAN, and TRABUE, M. R. A Measure of Ability to Judge Poetry. *Teachers College Record*, March, 1921, p. 121.

17. BRIGGS, THOMAS H. An English Form Test. *Teachers College Record*, Jan., 1921, p. 5.
18. WOOD, BEN D. Measurement of Law School Work. *Columbia Law Review*, Vol. 24, No. 3 (March, 1924). This article has also been re-issued as a reprint and it is to this reprint that reference is made in the text.
19. BRIGHAM, C. C. *A Study of American Intelligence*. 1922, p. 16.
20. STENQUIST, J. L. Unreliability of Individual Scores in Mental Measurements. *Journal of Educational Research*, December, 1921, p. 350.
21. THURSTONE, L. L. A Cycle Omnibus Intelligence Test for College Students. *Journal of Educational Research*, Vol. 4, p. 268.
22. WHIPPLE, GUY M. Intelligence Tests in Colleges and Universities. *Twenty-first Year-Book of the National Society for the Study of Education*, 1922.
23. MCCALL, WILLIAM A. A Uniform Method of Scale Construction. *Teachers College Record*, January, 1921, pp. 31-51.
24. RUGG, H. O. *Statistical Methods Applied to Education*. 1917.
25. PEARSON, KARL (editor). *Tables for Statisticians and Biometricians*. 1914.
26. RUGG, H. O. *Twenty-First Year-Book of the National Society for the Study of Education*, 1922, p. 77.
27. BROWN, WILLIAM. *The Essentials of Mental Measurement*. 1911, pp. 101-2.
28. BURGESS, MAY A. *The Measurement of Silent Reading*. p. 77.
29. KELLEY, TRUMAN L. *Statistical Method*. 1923, p. 205.
30. WOOD, BEN D. *Measurement in Higher Education*. 1923, pp. 45-51.

VITA

ANDREW TENNANT WYLIE was born in Indianapolis, Indiana, September 24, 1881. He attended the public schools of Indianapolis, graduating from the Manual Training High School in February, 1900. From 1900 to 1902 he served as laboratory assistant in the Manual Training High School, in physics, botany, and physiology, and then entered Indiana University. Here he specialized in English and chemistry, receiving an A. B. in 1906 and an A.M. in 1907; and was elected an alumnus member of Phi Beta Kappa in 1911. He was appointed teaching fellow in English in 1907 and instructor in 1908, holding this latter position until 1914 when he entered Columbia University as a part-time student and teaching assistant in the department of English, School of Practical Arts, Teachers College. Summarized from that time his record is as follows: 1914-1917, teaching assistant, Teachers College; 1917-1918, editorial assistant, *Teachers College Record*; 1918 (June)-1919 (January), field examiner and technical editor, Trade Test Division, Committee on Classification of Personnel in the Army; 1919 (January-March), educational secretary and director for the Y.M.C.A., Pelham Bay and Third Naval District, New York; 1921 (September)-1922 (January), on educational research staff, the Carnegie Foundation, New York City; 1922 (Summer Session), lecturer in educational psychology, University of California. During the period 1914-1922 Mr. Wylie was a student from time to time at Columbia University, specializing under the Institute of Educational Research, and completing the requirements for the doctorate (except for the publication of the dissertation) in 1922.

From 1922 to 1925 Mr. Wylie was attached to the Civilian Advisory Board, General Staff, War Department, as psychologist and trade-test expert, with permanent station at the Service School of the United States Signal Corps, Camp Alfred Vail, New Jersey. Here he acted as chairman of the civilian personnel attached to the Advisory Board; he also devised and conducted a number of psychological and other tests and served as editor and

test expert for a series of text-books on various army trades for signal corps specialists. Among these volumes already printed are: *Basic Signal Communication* (1923), *Telephone Switchboard Operator* (1923), *Message Center Specialist* (1923), and the *Pigeoneer* (1923); also the *Meteorological Observer* to be published in 1925.

Mr. Wylie has collaborated with Major Charles N. Sawyer, U. S. Signal Corps, in the production of two texts on army education (published provisionally in pamphlet form, 1924): *Signal Corps Training Problems* (2 vols.), and *Training Methods for All Arms*. He is also the author of the articles: "A Brief History of Mental Tests," *Teachers College Record*, January 1922 (originally prepared for Bisch's *Clinical Psychology*, 1925); and "Army Experiments with Progress and Proficiency Tests," *Educational Record*, October, 1924.

